INSTALLATION RESTORATION PROGRAM

PHASE I-RECORDS SEARCH

AAC-NORTHERN REGION

Galena AFS
Campion AFS
Cape Lisburne AFS
Fort Yukon AFS
Indian Mountain AFS
Kotzebue AFS
Murphy Dome AFS
Tin City AFS

PREPARED FOR

UNITED STATES AIR FORCE

AFESC/DEV

Tyndall AFB, Florida
and

AAC/DEPV

Elmendorf AFB, Alaska

SEPTEMBER 1985

NOTICE

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This report identified and evaluated several potentially hazardous waste disposal sites at Galena AFS, Campion AFS, Cape Lisburne AFS, Fort Yukon AFS, Indian Mountain AFS, Kotzebue AFS, Murphy Dome AFS, and Tin City AFS. Records of past waste handling and disposal practices were reviewed. Interviews with past and present installation employees were conducted to develop a history of waste disposal practices. The environmental setting for effectively receiving the wastes was evaluated including soils, geology, ground water and surface water. A total of 54 sites were found to have sufficient potential to create environmental contamination and follow-on investigations (Phase II) were recommended and outlined. The sites requiring further action include landfills, dump areas, spill and leak areas, fire protection training areas, communications areas, road oiling areas and waste accumulation areas.

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INSTALLATION RESTORATION PROGRAM
PHASE I: RECORDS SEARCH

AAC-NORTHERN REGION

Galena AFS, Campion AFS, Cape Lisburne AFS,
Fort Yukon AFS, Indian Mountain AFS, Kotzebue AFS,
Murphy Dome AFS and Tin City AFS

Prepared For

United States Air Force
AFESC/DEV
Tyndall AFB, Florida
and
AAC/DEPV
Elmendorf AFB, Alaska

September, 1985

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EXECUTIVE SUMMARY

The Department of Defense (DOD) has developed a program to identify and evaluate past hazardous material disposal sites on DOD property, to control the migration of hazardous contaminants, and to control hazards to health or welfare that may result from these past disposal operations. This program is called the Installation Restoration Program (IRP). The IRP has four phases consisting of Phase I, Installation Assessment/Records Search; Phase II, Confirmation/Quantification; Phase III, Technology Base Development (Research and Development); and Phase IV, Operations/Remedial Actions. Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I, Initial Assessment/Records Search for the Alaskan Air Command (AAC) Northern Region Installations under Contract No. F08637 84 C0070. The locations of these installations are shown in Figure 1.

INSTALLATION DESCRIPTION

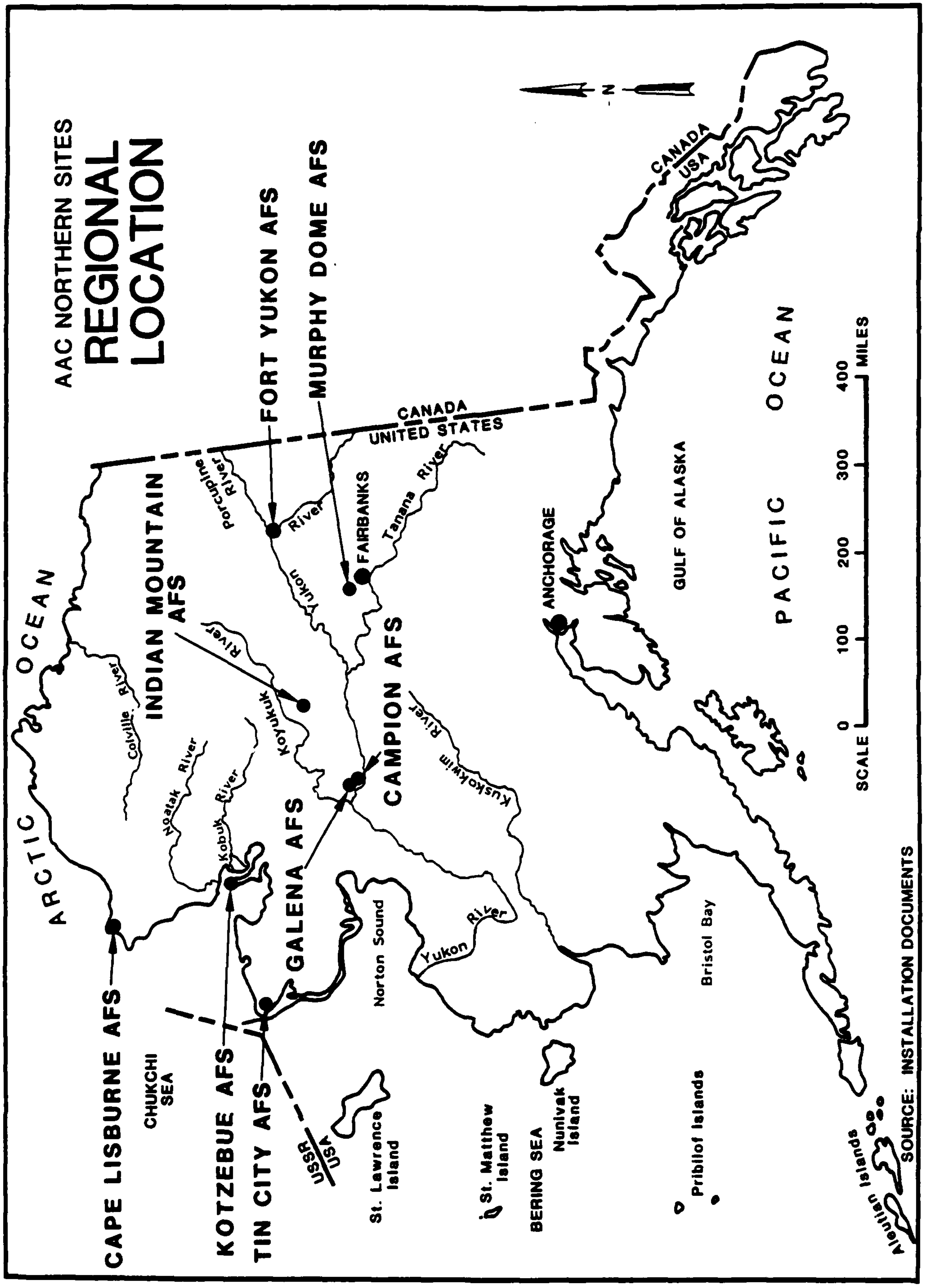
Galena AFS

Galena Air Force Station (AFS) is a 166-acre forward operating base located on the Yukon River some 350 miles northwest of Anchorage. Golden Airport is State-owned and is jointly operated by the Air Force and the State of Alaska. It was originally established in 1943. The airfield is used for military, commercial and general aviation purposes. Tactical aircraft have been based at Galena AFS since 1951.

Campion AFS

Campion AFS is a deactivated Long-Range Radar (LRR) facility that operated during the period 1951-1984. It is located 12 miles east of Galena AFS and consists of 2,395 acres of land.

FIGURE 1


AAC NORTHERN SITES
REGIONAL LOCATION
CAPE LISBURNE AFS
KOTZEBUE AFS
TIN CITY AFS
GALENA AFS
CAMPION AFS
INDIAN MOUNTAIN AFS
FORT YUKON AFS
MURPHY DOME AFS
ARCTIC OCEAN
CHUKCHI SEA
BERING SEA
Norton Sound
Bristol Bay
GULF OF ALASKA
PACIFIC OCEAN
St. Lawrence Island
St. Matthew Island
Nunivak Island
Pribilof Islands
Aleutian Islands
USSR
USA
CANADA
UNITED STATES
CANADA
USA
FAIRBANKS
ANCHORAGE
Colville River
Noatak River
Kobuk River
Koyukuk River
Yukon River
Porcupine River
Tanana River
Kuskokwim River
N
SCALE
0 100 200 300 400 MILES
SOURCE: INSTALLATION DOCUMENTS

Cape Lisburne AFS

Cape Lisburne AFS is a 1,125-acre site located some 810 miles northwest of Anchorage along the Chukchi Sea shore in the Alaska Maritime National Wildlife Refuge. The installation has been in continuous operation since 1952. It consists of a Lower Camp where support facilities are situated, and an Upper Camp where the radar equipment is located.

Fort Yukon AFS

Fort Yukon AFS is located on 326 acres of land within the Yukon Flats National Wildlife Refuge, approximately 440 miles northeast of Anchorage. The installation has been in continuous operation since 1958.

Indian Mountain AFS

Indian Mountain AFS is a 4,226-acre site located approximately 375 miles northwest of Anchorage. The installation consists of a Lower Camp, where the airfield and support facilities are situated, and an Upper Camp atop Indian Mountain, where the radar equipment is located. Indian Mountain AFS has been in continuous service since 1953.

Kotzebue AFS

Kotzebue AFS is a 676-acre site overlooking Kotzebue Sound, approximately 610 miles northwest of Anchorage. The facility has been in continuous service since 1950.

Murphy Dome AFS

Murphy Dome AFS is an 876-acre site situated on Murphy Dome, a rounded mountain top approximately 20 miles northwest of Fairbanks. The site has been in service since 1951.

Tin City AFS

Tin City AFS is a 748-acre site located near the village of Tin City, approximately 700 miles northwest of Anchorage. The installation consists of a Lower Camp where support facilities are situated and an Upper Camp atop Cape Mountain where the radar equipment is located. Tin City AFS has been in service since 1953.

ENVIRONMENTAL SETTING

The environmental setting data reviewed for this investigation identified the following points relevant to the AAC Northern Region installations:

- Precipitation distribution across the state is highly variable. The greatest amounts of precipitation are measured on the coastal mountain ranges; the least amounts are measured in the interior lowlands. No values have been published for the amounts of annual precipitation that may be available for infiltration at the various AAC installations. It is assumed that at least one inch of annual precipitation is able to percolate through surface soils and recharge local aquifers.

- Most installation surface soils have been described as being generally permeable. Permafrost has been shown to have a major impact on soil permeability. The seasonal conditions existing at each installation are highly variable. Seasonal frost penetrating surface soils at installations such as Fort Yukon AFS, Cape Lisburne AFS and Kotzebue AFS would do so to the permafrost table rendering all surficial materials relatively impermeable until the next melt and thaw cycle. Discontinuous permafrost present at Galena AFS and Campion AFS would be expected to impact surface soil permeability locally, especially during the winter season.

- A shallow aquifer, probably in hydraulic communication with local surface waters, exists at all eight facilities. All or at least a part of each installation is likely situated within the recharge zone of the respective shallow aquifers.

- A regional aquifer (Yukon River alluvium) is present at Galena AFS, Campion AFS and Fort Yukon AFS. The regional aquifer probably receives some of its recharge from the over-lying installation land areas. No regional aquifers were determined to be present at the remaining five sites.

- The regional aquifer at Galena AFS (Yukon River channel alluvium) is contaminated by POL products and/or solvents.

- The shallow aquifers underlying Kotzebue AFS and Indian Mountain AFS have been confirmed as being contaminated by POL product losses from the installations. The shallow aquifer at Cape Lisburne AFS may have been contaminated by past POL spills.

- The surface waters receiving discharge from the seven active installations are classified for high water quality and use standards.

- No endangered or threatened species of plants or animals is known to be in residence at any of the installations included within the scope of this study. The Peregrine Falcon could, however, be a transient at Galena AFS, Campion AFS or Tin City AFS.

- Wetland areas have been identified at or adjacent to Galena AFS, Campion AFS, Fort Yukon AFS and Kotzebue AFS. The wetland areas are receiving runoff and sewage effluent discharge from these installations.

METHODOLOGY

During the course of this project, interviews were conducted with installation personnel (past and present) familiar with past waste disposal practices; file searches were performed for past hazardous waste activities; interviews were held with local, state and federal agencies; and field surveys were conducted at suspected past hazardous waste

activity sites. Fifty-five sites/activities (Figures 2 through 9, located at the end of the Executive Summary) were initially identified as potentially containing hazardous contaminants and having the potential for contaminant migration resulting from past activities. These sites have been assessed using a Hazard Assessment Rating Methodology (HARM) which takes into account factors such as site characteristics, waste characteristics, potential for contaminant migration and waste management practices. The details of the rating procedure are presented in Appendix G and the results are given in Tables 1 through 8 (located at the end of the Executive Summary). The rating system is designed to indicate the relative need for follow-up investigation.

FINDINGS AND CONCLUSIONS

The conclusions have been developed based on the results of the field inspection, reviews of AAC and installation records and files, interviews with installation personnel, and evaluations using the HARM system. Tables 1 through 8 summarize the conclusions concerning site evaluations at the AAC Northern installations. The number of sites (including groups of several sites) found to have sufficient potential to create environmental contamination are as follows:

- Galena AFS 6 Sites
- Campion AFS 7 Sites
- Cape Lisburne AFS 6 Sites
- Fort Yukon AFS 5 Sites
- Indian Mountain AFS 11 Sites
- Kotzebue AFS 4 Sites
- Murphy Dome AFS 7 Sites
- Tin City AFS 8 Sites

RECOMMENDATIONS

A program for proceeding with Phase II and other IRP activities at the AAC Northern Region installations is presented in Section 6 for each installation and potential contamination site. The recommended program consists of various activities such as geophysical and hydrogeological surveys, soil excavation/borings, ground-water monitoring wells, and

soil and water sampling and analysis designed to determine if contamination exists. This Phase II program may need to be expanded to define the extent and type of contamination if the initial step reveals contamination.

TABLE 1
CONCLUSIONS CONCERNING SITES EVALUATED AT
GALENA AFS

Rank	Site	Operation Period	HARM Score (1)	Follow-On Action Warranted (2)
1.	Waste Accumulation Area	1950's-Present	80	Yes
2.	Spill/Leak No. 1	1940's-1960's	75	Yes
3.	Spill/Leak No. 2	Mid-1950's	75	Yes
4.	POL Tank Farm and Spill/Leak Nos. 4 and 5	1950's-Present, 1985, 1980's	69	Yes
5.	Fire Protection Training Area	Late 1950's-Present	69	Yes
6.	Spill/Leak No. 3	1984	63	Yes

(1) This ranking was obtained using the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.

(2) These conclusions are based on field inspections, file data, interviews, environmental setting and HARM assessments.

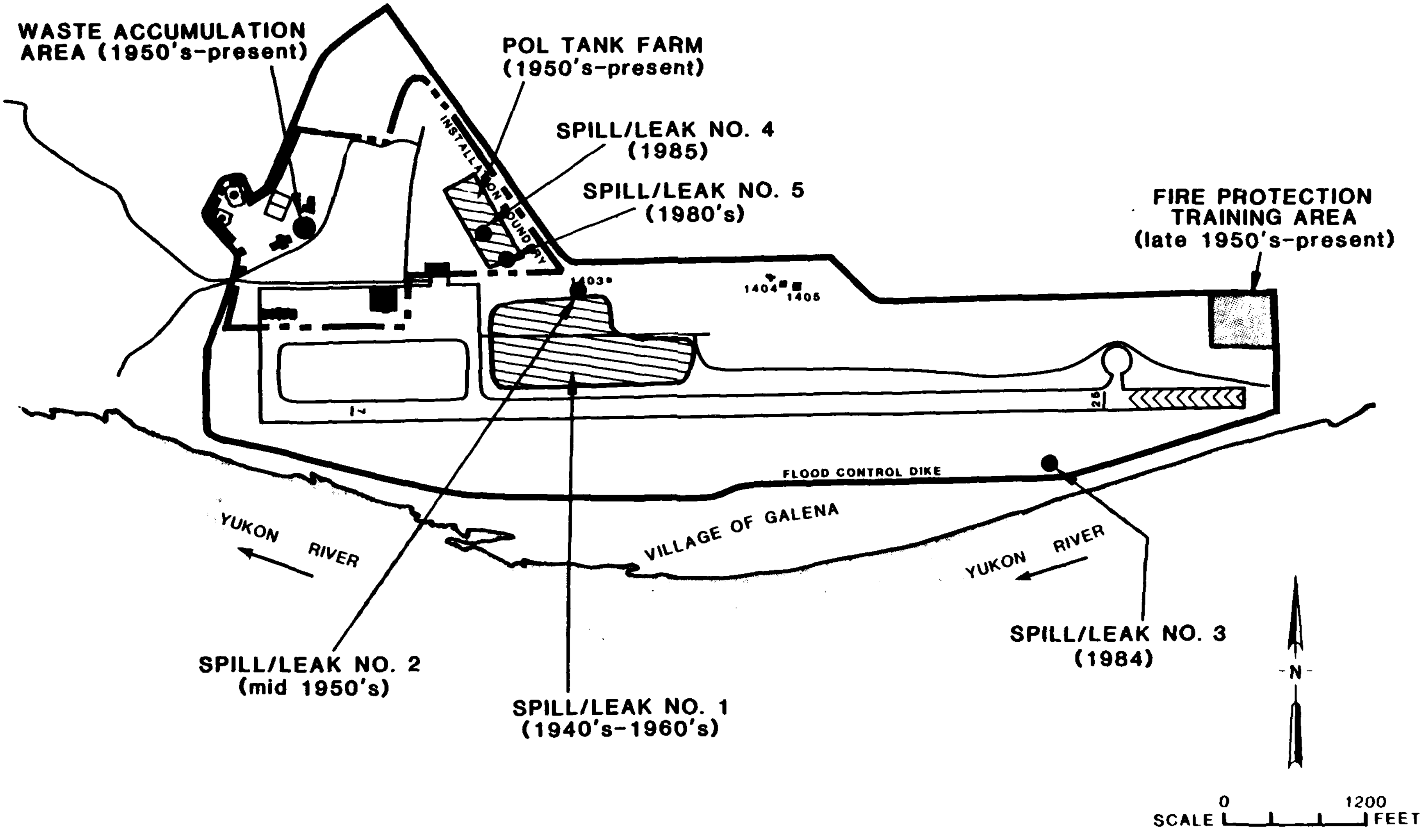
Source: Engineering Science

FIGURE 2

AAC NORTHERN REGION

GALENA AFS

SITES OF POTENTIAL ENVIRONMENTAL CONTAMINATION



SOURCE: INSTALLATION DOCUMENTS

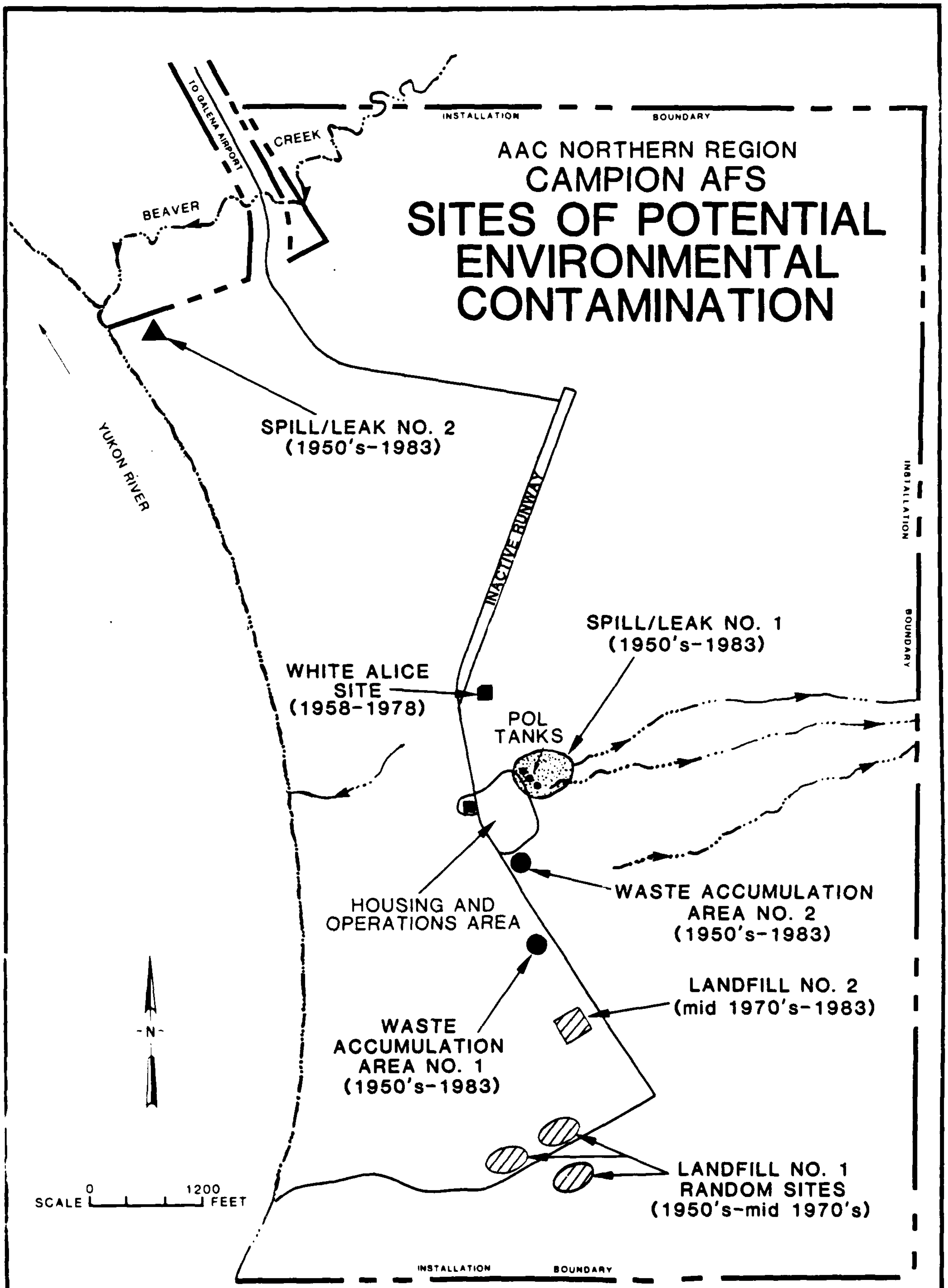
TABLE 2
CONCLUSIONS CONCERNING SITES EVALUATED AT
CAMPION AFS

Rank	Site	Operation Period	HARM Score(1)	Follow-On Action Warranted(2)
1.	Landfill No. 1	1950's-1970's	59	Yes
2.	Spill/Leak No. 1	1950's-1983	56	Yes
3.	Waste Accumulation Area No. 2	1950's-1983	56	Yes
4.	Landfill No. 2	1970's-1983	56	Yes
5.	Spill/Leak No. 2	1950's-1983	54	Yes
6.	Waste Accumulation Area No. 1	1950's-1983	54	Yes
7.	White Alice Site	1958-1978	49	Yes

(1) This ranking was obtained using the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.

(2) These conclusions are based on field inspections, file data, interviews, environmental setting and HARM assessments.

Source: Engineering Science



SOURCE: INSTALLATION DOCUMENTS

TABLE 3
CONCLUSIONS CONCERNING SITES EVALUATED AT
CAPE LISBURNE AFS

Rank	Site (Location)(1)	Operation Period	HARM Score(2)	Follow-On Action Warranted(3)
1.	Spill/Leak No. 1 (LC)	1980	71	Yes
2.	Dump No. 2 (UC)	1950's-Late 1970's	67	Yes
3.	Spill/Leak No. 2 (LC)	1982	66	Yes
4.	Landfill and Waste Accumulation Area No. 2/Dump No. 1 (LC)	1950's-Present, 1950's-1970's	62	Yes
5.	Runway Oiling (LC)	1950's-1970's	52	Yes
6.	White Alice Site (LC)	1957-1979	49	Yes

(1) (LC) = Lower Camp; (UC) = Upper Camp

(2) This ranking was obtained using the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.

(3) These conclusions are based on field inspections, file data, interviews, environmental setting and HARM assessments.

Source: Engineering Science

FIGURE 4

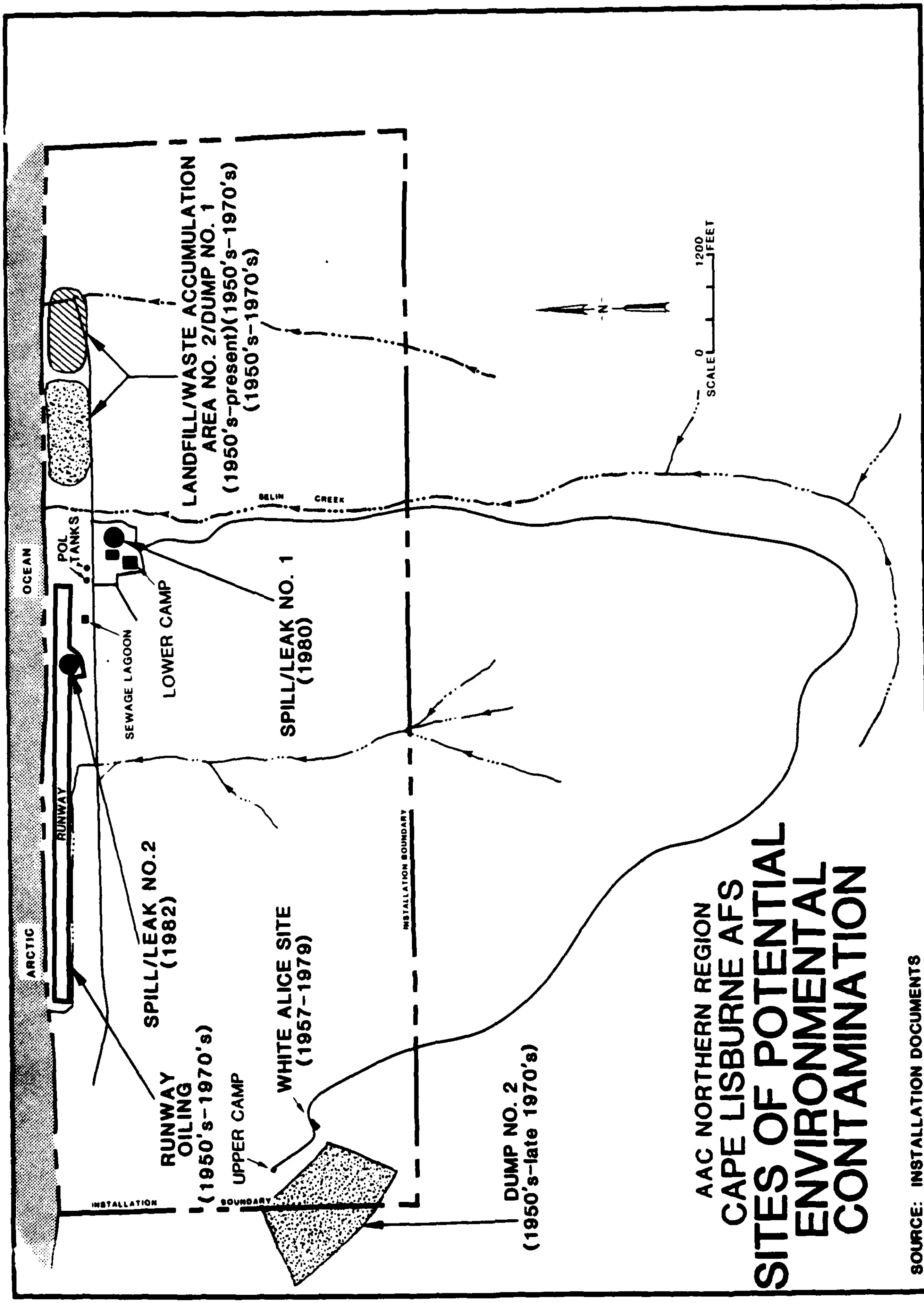


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TABLE 4
CONCLUSIONS CONCERNING SITES EVALUATED AT
FORT YUKON AFS

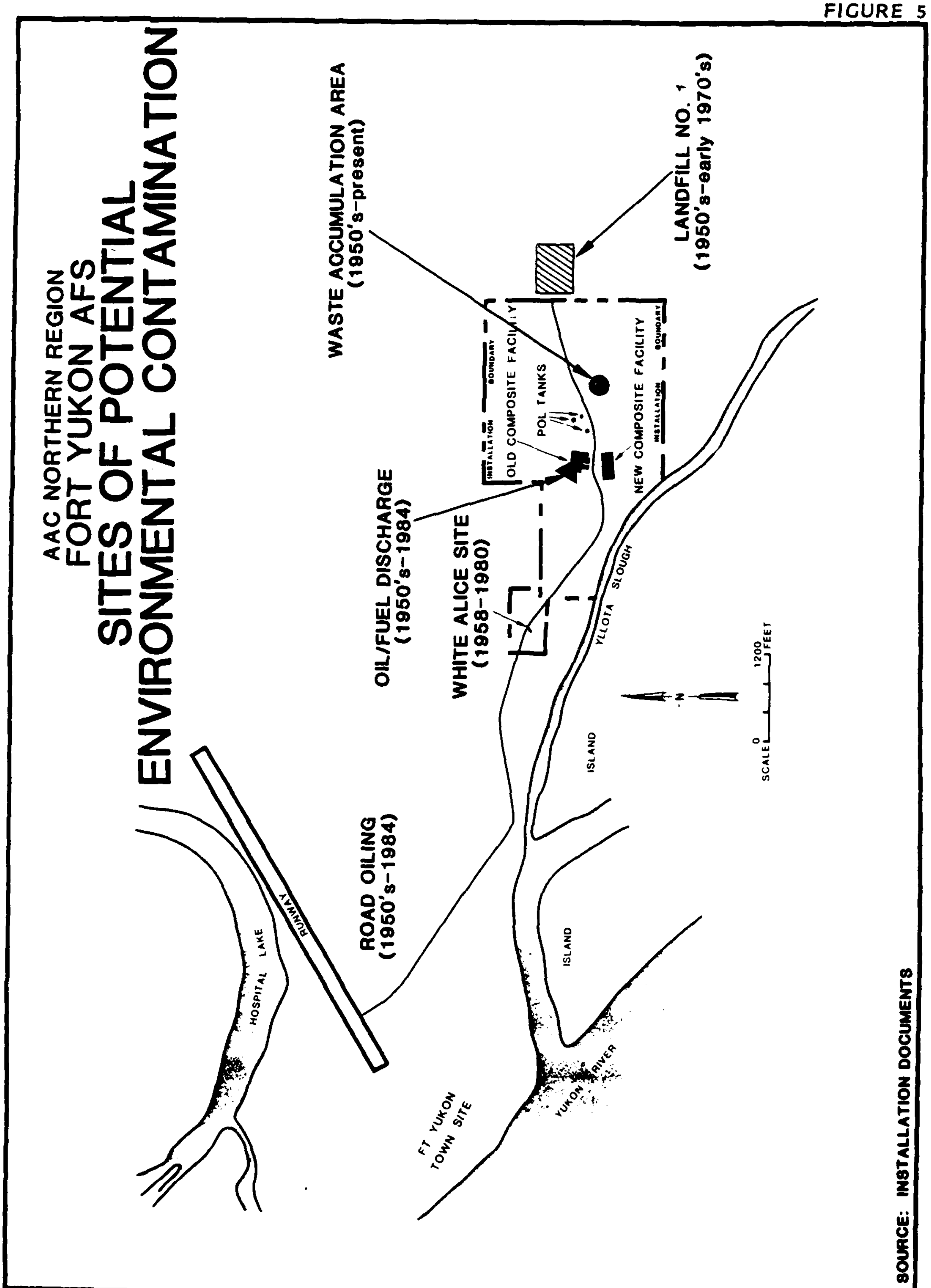
Rank	Site	Operation Period	HARM Score (1)	Follow-On Action Warranted (2)
1.	Road Oiling	1950's-1984	61	Yes
2.	Waste Accumulation Area	1950's-Present	59	Yes
3.	Landfill No. 1	1950's-Early 1970's	58	Yes
4.	Oil/Fuel Discharge	1950's-1984	56	Yes
5.	White Alice Site	1958-1980	54	Yes

(1) This ranking was obtained using the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.

(2) These conclusions are based on field inspections, file data, interviews, environmental setting and HARM assessments.

Source: Engineering Science

FIGURE 5



AAC NORTHERN REGION
FORT YUKON AFS
SITES OF POTENTIAL
ENVIRONMENTAL CONTAMINATION
WASTE ACCUMULATION AREA
(1950's-present)
LANDFILL NO. 1
(1950's-early 1970's)
INSTALLATION BOUNDARY
OLD COMPOSITE FACILITY
POL TANKS
NEW COMPOSITE FACILITY
INSTALLATION BOUNDARY
OIL/FUEL DISCHARGE
(1950's-1984)
WHITE ALICE SITE
(1958-1980)
YLLOTA SLOUGH
N
SCALE 0 1200 FEET
ISLAND
ISLAND
ROAD OILING
(1950's-1984)
RUNWAY
HOSPITAL LAKE
FT YUKON TOWN SITE
YUKON RIVER
SOURCE: INSTALLATION DOCUMENTS

TABLE 5
CONCLUSIONS CONCERNING SITES EVALUATED AT
INDIAN MOUNTAIN AFS

Rank	Site (Location)[1]	Operation Period	HARM Score[2]	Follow-On Action Warranted[3]
1.	Spill/Leak Nos. 1, 3, and 8 (LC)	1973, 1974 1977	77	Yes
2.	Waste Accumulation Area No. 4 and Landfill Nos. 3 and 4 (LC)	1950's-1960's 1978-1980 1970's	71	Yes
3.	Waste Accumulation Area No. 6 and Spill/Leak Nos. 2, 5, 6, 7, 8 and 10 (UC)	1950's-Late 1970's, 1973, 1977/78, 1979	67	Yes
4.	Landfill No. 1 (LC)	1953-1977	65	Yes
5.	Waste Accumulation Area No. 1 (LC)	1950's-Present	65	Yes
6.	Waste Accumulation Area No. 3 and Spill/Leak Nos. 4 and 11 (LC)	1950's-1984 1976, 1970's	65	Yes
7.	Waste Accumulation Area No. 5 (LC)	1960's-1970's	65	Yes
8.	Road Oiling (LC/UC)	1950's-1984	65	Yes
9.	Dump Areas (UC)	1950's-1970's	64	Yes
10.	Landfill No. 2 (LC)	1977-Present	62	Yes
11.	White Alice Site	1958-1979	51	Yes

(1) (LC) = Lower Camp; (UC) = Upper Camp

(2) This ranking was obtained using the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.

(3) These conclusions are based on field inspections, file data, interviews, environmental setting and HARM assessments.

Source: Engineering Science

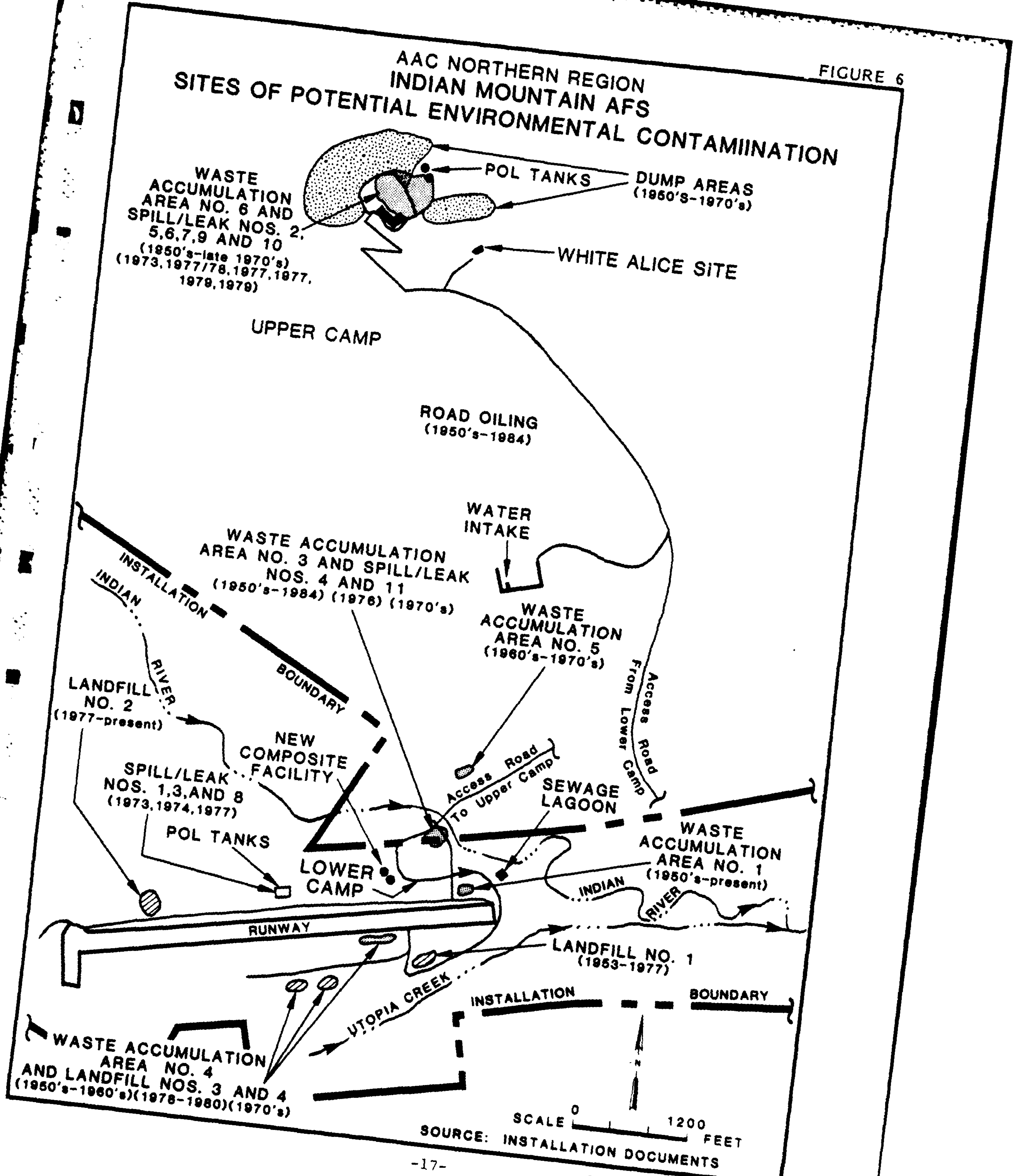


FIGURE 6
AAC NORTHERN REGION
INDIAN MOUNTAIN AFS
SITES OF POTENTIAL ENVIRONMENTAL CONTAMIINATION
WASTE ACCUMULATION AREA NO. 6 AND SPILL/LEAK NOS. 2, 5,6,7,9 AND 10
(1950's-late 1970's)
(1973,1977/76,1977,1977, 1979,1979)
POL TANKS
DUMP AREAS
(1960'S-1970's)
WHITE ALICE SITE
UPPER CAMP
ROAD OILING
(1950's-1984)
WATER INTAKE
WASTE ACCUMULATION AREA NO. 3 AND SPILL/LEAK NOS. 4 AND 11
(1950's-1984) (1976) (1970's)
WASTE ACCUMULATION AREA NO. 5
(1960's-1970's)
INSTALLATION BOUNDARY
INDIAN RIVER
Access Road From Lower Camp
LANDFILL NO. 2
(1977-present)
NEW COMPOSITE FACILITY
Access Road To Upper Camp
SEWAGE LAGOON
SPILL/LEAK NOS. 1,3,AND 8
(1973,1974,1977)
POL TANKS
LOWER CAMP
WASTE ACCUMULATION AREA NO. 1
(1950's-present)
INDIAN RIVER
RUNWAY
LANDFILL NO. 1
(1953-1977)
UTOPIA CREEK
INSTALLATION BOUNDARY
WASTE ACCUMULATION AREA NO. 4 AND LANDFILL NOS. 3 AND 4
(1950's-1960's)(1976-1980)(1970's)
N
SCALE 0 1200 FEET
SOURCE: INSTALLATION DOCUMENTS

TABLE 6
CONCLUSIONS CONCERNING SITES EVALUATED AT
KOTZEBUE AFS

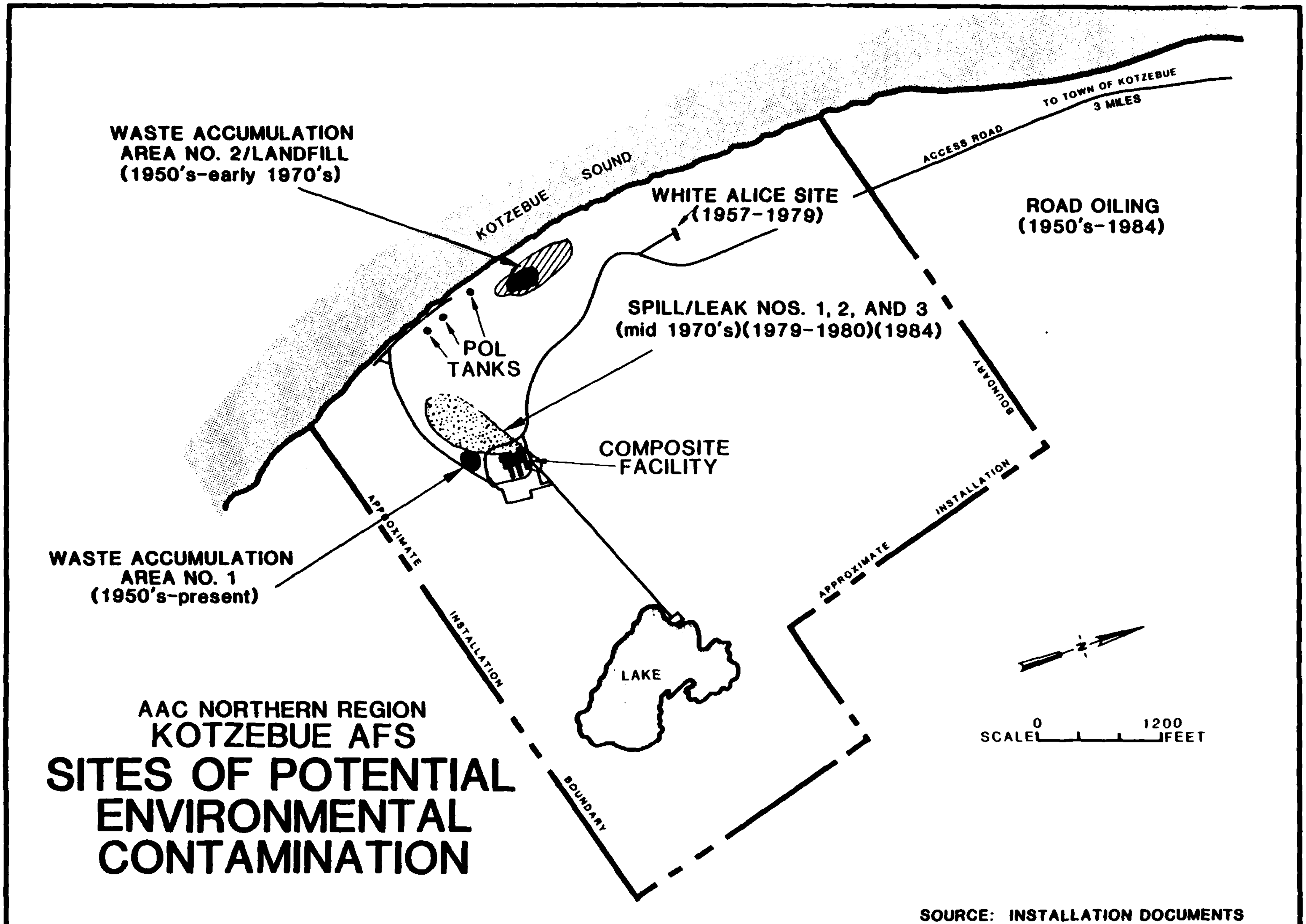
Rank	Site	Operation Period	HARM Score (1)	Follow-On Action Warranted (2)
1.	Spill/Leak Nos. 1, 2, and 3	Mid-1970's, 1979-1980, 1984	75	Yes
2.	Waste Accumulation Area No. 2/Landfill No. 1	1950's-Early 1970's	52	Yes
3.	Roal Oiling	1950's-1984	51	Yes
4.	Waste Accumulation Area No. 1	1950's-Present	49	Yes
5.	White Alice Site	1957-1979	46	No

(1) This ranking was obtained using the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.

(2) These conclusions are based on field inspections, file data, interviews, environmental setting and HARM assessments.

Source: Engineering Science

FIGURE 7



AAC NORTHERN REGION
KOTZEBUE AFS
SITES OF POTENTIAL ENVIRONMENTAL CONTAMINATION

SOURCE: INSTALLATION DOCUMENTS

TABLE 7
CONCLUSIONS CONCERNING SITES EVALUATED AT
MURPHY DOME AFS

Rank	Site	Operation Period	HARM Score(1)	Follow-On Action Warranted(2)
1.	Road Oiling	1950's-1972	57	Yes
2.	Landfill No. 2	1970-1977	55	Yes
3.	Landfill No. 1	1950's-1969	50	Yes
4.	Waste Accumulation Area No. 1 and Bulk POL Storage Area Spills	1970's-Present 1970-1981	50	Yes
5.	Waste Accumulation Area No. 2	1950's-1972	50	Yes
6.	Waste Accumulation Area No. 3	1950's-1970's	50	Yes
7.	White Alice Site	1950's-1970's	50	Yes

(1) This ranking was obtained using the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.

(2) These conclusions are based on field inspections, file data, interviews, environmental setting and HARM assessments.

Source: Engineering Science

FIGURE 8

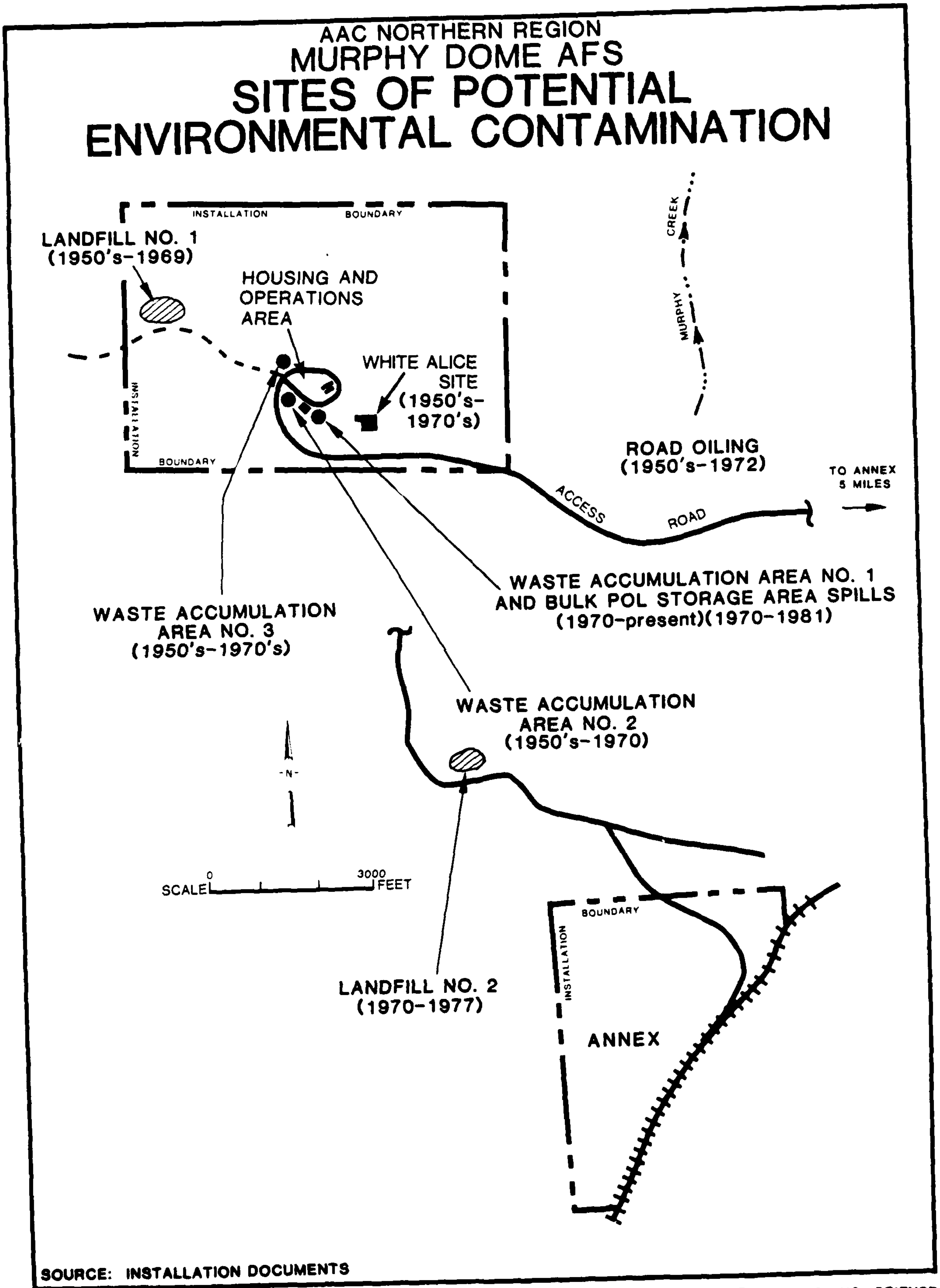


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TABLE 8
CONCLUSIONS CONCERNING SITES EVALUATED AT
TIN CITY AFS

Rank	Site (Location)[1]	Operation Period	HARM Score[2]	Follow-On Action Warranted[3]
1.	Dump No. 1 (UC)	1950's-Late 1970's	68	Yes
2.	Landfill (LC)	1950's-Present	62	Yes
3.	Dump No. 2 (LC)	1950's-Late 1970's	61	Yes
4.	Waste Accumulation Area (LC)	1950's-Present	60	Yes
5.	Spill/Leak No. 2 (LC)	1979	60	Yes
6.	Spill/Leak No. 1	1980	55	Yes
7.	White Alice Site	1958-1975	51	Yes
8.	Runway Oiling (LC)	1950's-1970's	50	Yes

(1) (LC) = Lower Camp; (UC) = Upper Camp

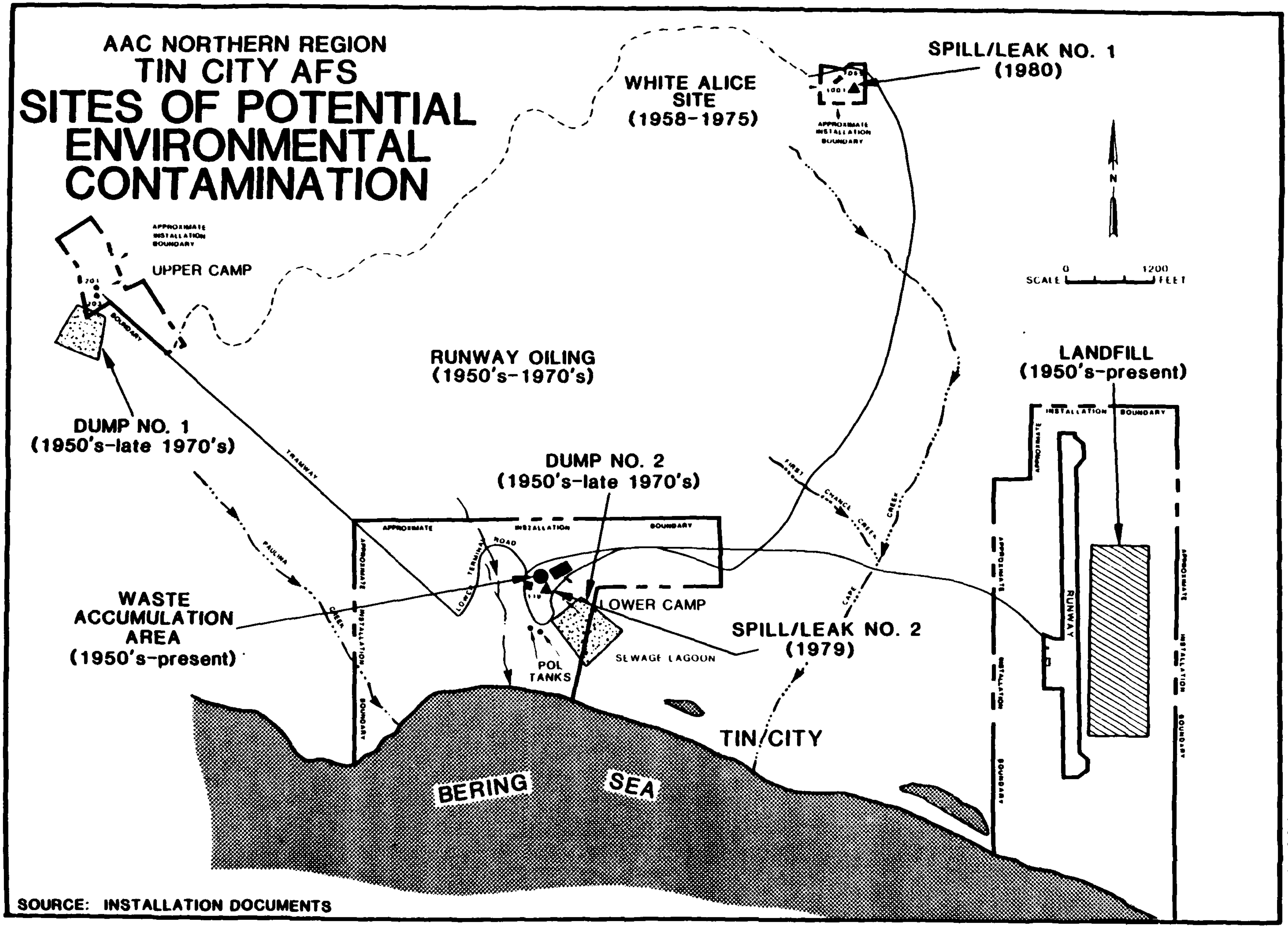
(2) This ranking was obtained using the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.

(3) These conclusions are based on field inspections, file data, interviews, environmental setting and HARM assessments.

Source: Engineering Science

FIGURE 9

AAC NORTHERN REGION TIN CITY AFS SITES OF POTENTIAL ENVIRONMENTAL CONTAMINATION



SOURCE: INSTALLATION DOCUMENTS

SECTION 1
INTRODUCTION

BACKGROUND AND AUTHORITY

The United States Air Force, due to its primary mission of defense of the United States, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations to require that disposers identify the locations and contents of past disposal sites and take action to eliminate hazards in an environmentally responsible manner. The primary Federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Section 6003 of the Act, Federal agencies are directed to assist the Environmental Protection Agency (EPA) and under Section 3012, state agencies are required to inventory past disposal sites, and Federal agencies are required to make the information available to the requesting agencies. To assure compliance with these hazardous waste regulations, the Department of Defense (DOD) developed the Installation Restoration Program (IRP). The current DOD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated 11 December 1981 and implemented by Air Force message dated 21 January 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the Installation Restoration Program. DOD policy is to identify and fully evaluate suspected problems associated with past hazardous contamination, and to control hazards to health and welfare that resulted from these past operations. The IRP is the basis for response actions on Air Force installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, clarified by Executive Order 12316. CERCLA is the primary legislation governing remedial action at past hazardous waste disposal sites.

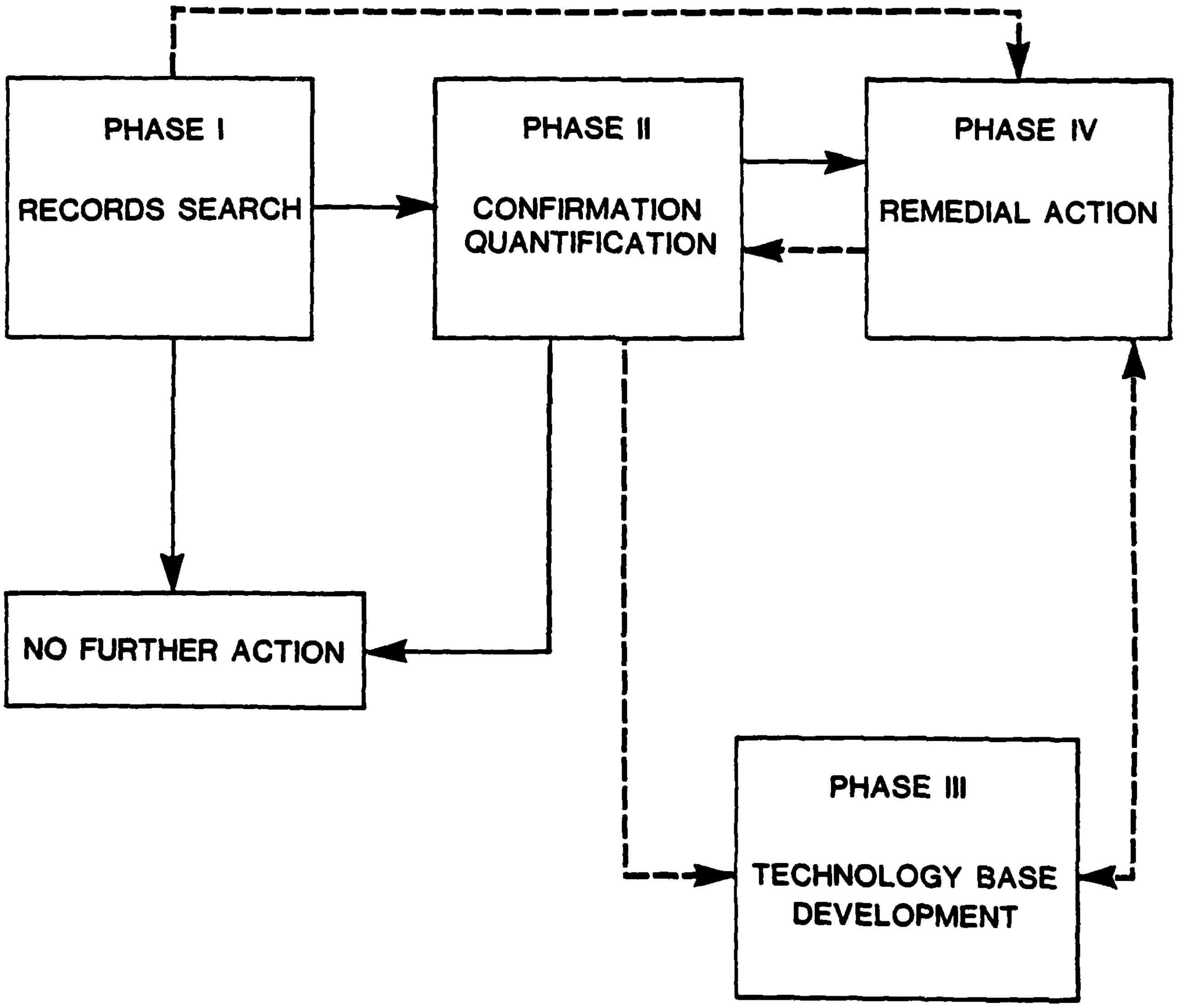
PURPOSE AND SCOPE

The Installation Restoration Program is a four-phased program (Figure 1.1) designed to assure that identification, confirmation/quantification, and remedial actions are performed in a timely and cost-effective manner. Each phase is briefly described below:

- Phase I - Installation Assessment/Records Search - Phase I is to identify and prioritize those past disposal sites that may pose a hazard to public health or the environment as a result of contaminant migration to surface or ground waters, or have an adverse effect by its persistence in the environment. In this phase it is determined whether a site requires further action to confirm an environmental hazard or whether it may be considered to present no hazard at this time. If a site requires immediate remedial action, such as removal of abandoned drums, the action can proceed directly to Phase IV. Phase I is a basic background document for the Phase II study.
- Phase II - Confirmation/Quantification - Phase II is to define and quantify, by preliminary and comprehensive environmental and/or ecological survey, the presence or absence of contamination, the extent of contamination, waste characterization (when required by the regulatory agency), and to identify sites or locations where remedial action is required in Phase IV. Research requirements identified during this phase will be included in the Phase III effort of the program.
- Phase III - Technology Base Development (Research and Development) - Phase III is to develop a sound data base upon which to prepare a comprehensive remedial action plan. This phase includes implementation of research requirements and technology for objective assessment of adverse effects. A Phase III requirement can be identified at any time during the program.
- Phase IV - Operations/Remedial Actions - Phase IV includes the preparation and implementation of the remedial action plan.

Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I Records Search at several Air Force

U.S. AIR FORCE INSTALLATION RESTORATION PROGRAM



SOURCE: AFESC

Stations (AFS) and Long-Range Radar (LRR) sites (AFS and LRR are used synonymously throughout this report) in the Northern Region of the Alaskan Air Command (AAC) under Contract No. F08637 84 C0070. This report contains a summary and an evaluation of the information collected during Phase I of the IRP and recommended follow-on actions. The installations investigated and the land areas included as part of the AAC Northern Region study are as follows:

- Galena AFS	166 acres
- Campion AFS	2,395 acres
- Cape Lisburne AFS	1,125 acres
- Fort Yukon AFS	326 acres
- Indian Mountain AFS	4,226 acres
- Kotzebue AFS	676 acres
- Murphy Dome AFS	846 acres
- Tin City AFS	748 acres

The activities performed as a part of the Phase I study scope included the following:

- Review of site records
- Interviews with personnel familiar with past waste generation and disposal activities
- Survey of types and quantities of wastes generated
- Determination of current and past hazardous waste treatment, storage, and disposal activities
- Description of the environmental setting at the installation
- Review of past disposal practices and methods
- Reconnaissance of field conditions
- Collection of pertinent information from federal, state and local agencies
- Assessment of the potential for contaminant migration
- Development of recommendations for follow-on actions

ES performed the on-site portion of the Records Search from June 5-21, 1985. Specific site visit dates were: Galena AFS (June 11-13),

Campion AFS (June 11-13), Cape Lisburne AFS (June 8-9), Fort Yukon AFS (June 13-14), Indian Mountain AFS (June 13-14), Kotzebue AFS (June 9-10), Murphy Dome AFS (June 14-15) and Tin City AFS (June 10-11). The following team of professionals was involved:

- R. L. Thoem, Environmental Engineer and Project Manager, MS Sanitary Engineering, 21 years of professional experience in environmental engineering.

- J. R. Absalon, Hydrogeologist, BS Geology, 12 years of professional experience in geology and ecology.

- R. M. Palazzolo, Environmental Engineer, MS Environmental Engineering, 4 years of professional experience in environmental engineering.

More detailed information on these three individuals is presented in Appendix A.

METHODOLOGY

The methodology utilized in the AAC Northern Region Records Search began with a review of past and present industrial operations conducted at the installation. Information was obtained from available records such as shop files and real property files, as well as interviews with 54 past and present installation employees. Those interviewed included personnel having responsibilities for civil engineering, bioenvironmental engineering, fuels management, mechanical systems, radar operations, roads and grounds maintenance, fire protection, real property, and history. A listing of interviewe positions with approximate years of service is presented in Appendix B.

Concurrent with the employee interviews, the applicable federal, and state agencies were contacted for pertinent study area related

environmental data. The agencies contacted are listed below and in Appendix B.

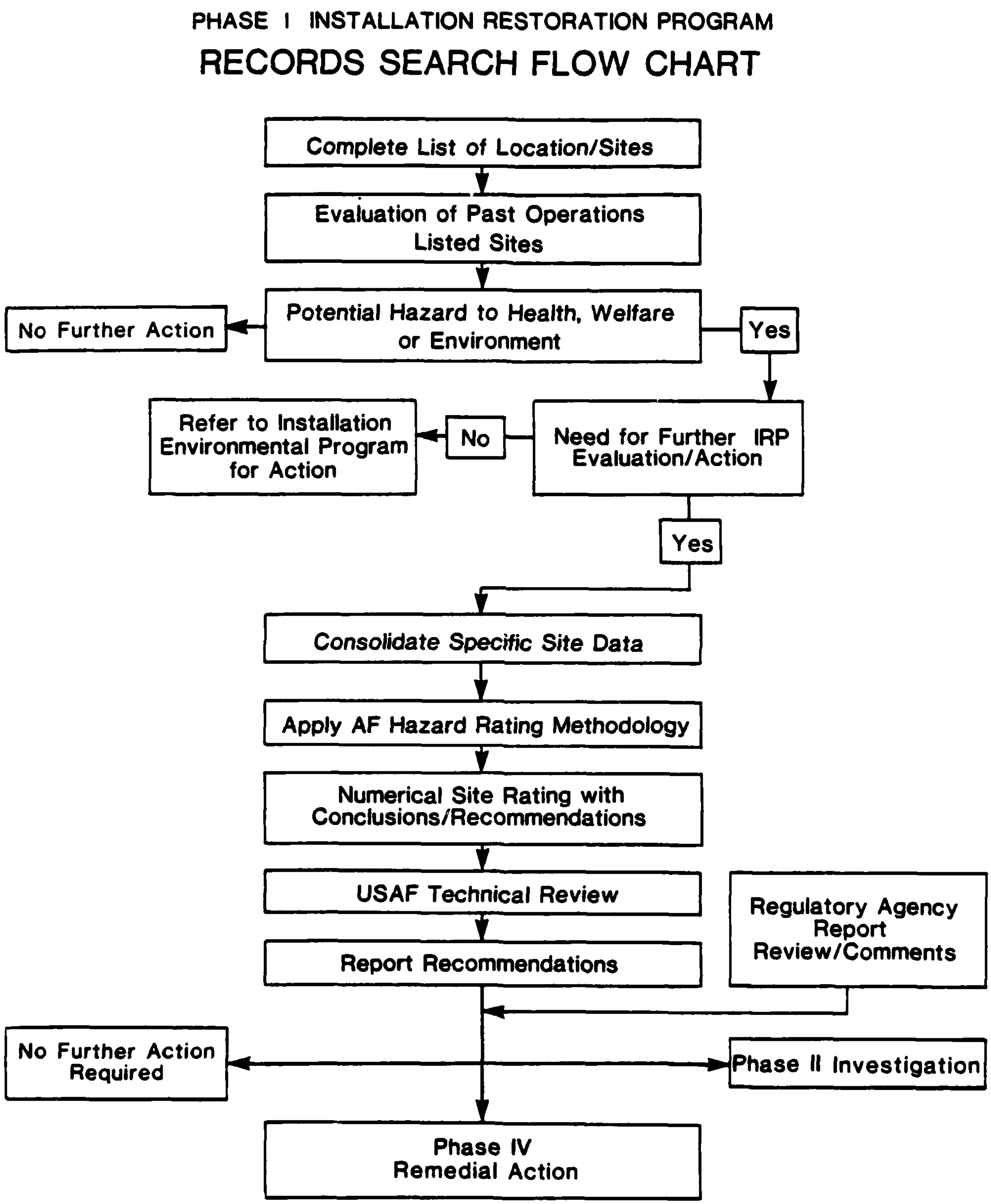
- U. S. Environmental Protection Agency - Alaska Operations Office (Anchorage, AK)
- U. S. Bureau of Land Management - Property Management Branch (Anchorage, AK)
- U. S. Bureau of Land Management - Biological Resources Branch (Anchorage, AK)
- U. S. Fish and Wildlife Service (Anchorage, AK)
- U. S. Department of Agriculture - Soil Conservation Service (Anchorage, AK)
- U. S. Geological Survey - Water Resources Division (Anchorage, AK)
- U. S. Army Corps of Engineers - Alaska District (Anchorage, AK)
- Alaska Department of Environmental Conservation (Anchorage and Fairbanks, AK)
- Alaska Department of Fish and Game (Anchorage and Bethel, AK)
- University of Alaska - Arctic Information and Data Center (Anchorage, AK)

The next step in the activity review was to identify all sources of hazardous waste generation and to determine the past management practices regarding the use, storage, treatment, and disposal of hazardous materials from the various sources on the installation. Included in this part of the activities review was the identification of all known past disposal sites and other possible sources of contamination such as spill areas.

A general ground tour of the identified sites was made by a member of the ES Project Team to gather site-specific information including: (1) general observations of existing site conditions; (2) visual evidence of environmental stress; (3) presence of nearby drainage ditches or surface waters; and (4) visual inspection of these water bodies for any obvious signs of contamination or leachate migration.

A decision was then made, based on all of the above information, whether a potential hazard to health, welfare or the environment exists

at any of the identified sites using the Flow Chart shown in Figure 1.2. If no potential existed, the site received no further action. For those sites where a potential hazard was identified, a determination of the need for IRP evaluation/action was made by considering site-specific conditions. If no further IRP evaluation was determined necessary, then the site was referred to the installation environmental program for appropriate action. If a site warranted further investigation, it was evaluated and rated using the Hazard Assessment Rating Methodology (HARM). The HARM score is a resource management tool which indicates the relative potential for adverse effects on health or the environment at each site evaluated.



Source: AFESC

SECTION 2

INSTALLATION DESCRIPTION

LOCATION, SIZE AND BOUNDARIES

The Air Force installations included in the Phase I IRP Study are located in the State of Alaska. This report includes eight installations located on land that is owned or permitted for use by the Air Force. The AAC Northern Region installations include a Forward Operating Base (Galena AFS) and seven Long-Range Radar (LRR) sites. These LRR sites are Campion AFS, Cape Lisburne AFS, Fort Yukon AFS, Indian Mountain AFS, Kotzebue AFS, Murphy Dome AFS and Tin City AFS. The location of these installations is shown in Figure 2.1.

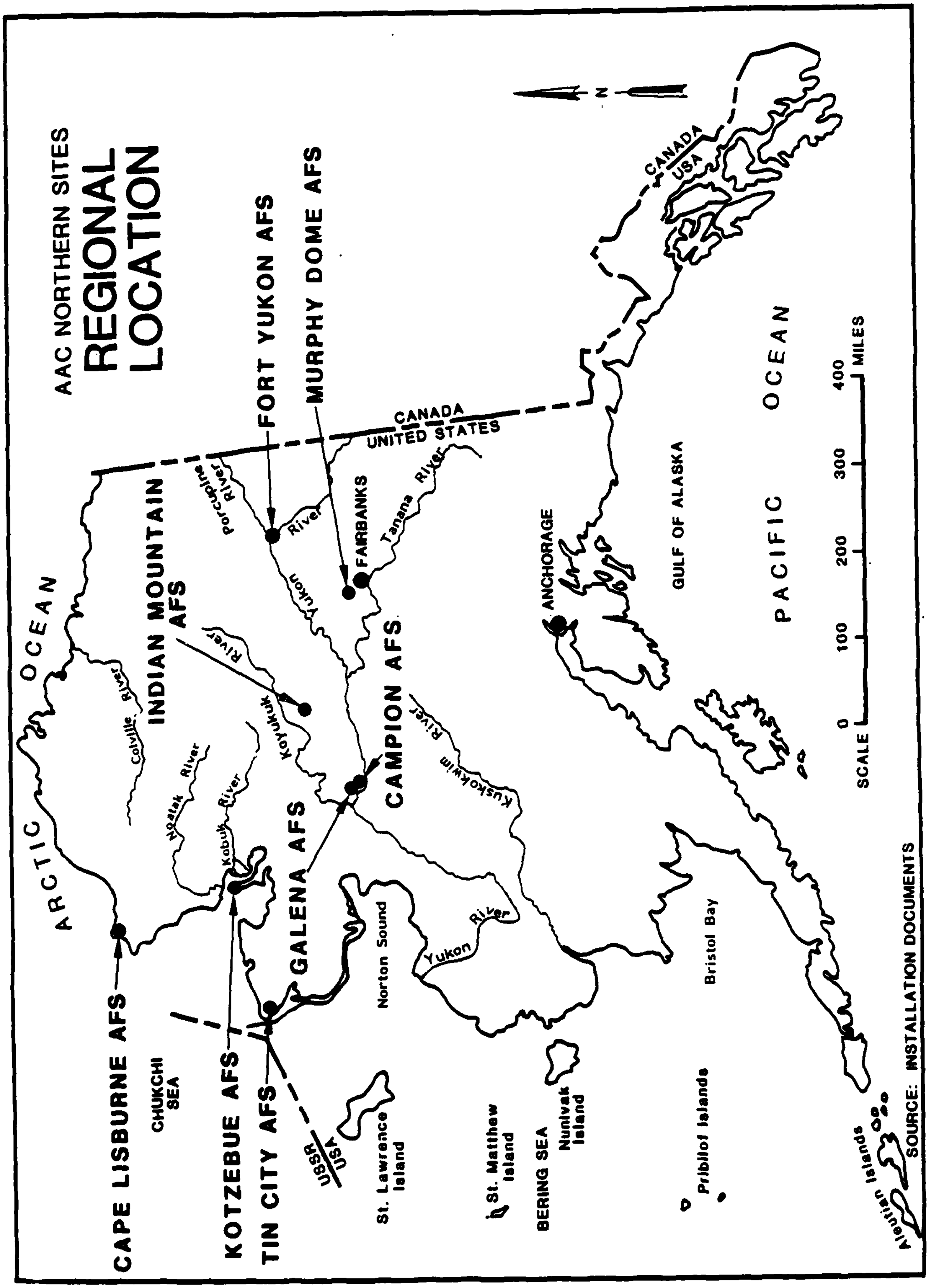
Galena AFS

Galena Airport, the northernmost forward operating base in Alaska, is State-owned and jointly operated by the State of Alaska and the U.S. Air Force (USAF). The major tenants at the airport are the Air Force, the Federal Bureau of Land Management (BLM) and the Federal Aviation Administration (FAA). Galena AFS consists of 166 acres of land located along the Yukon River. The station is 350 miles northwest of Anchorage and 280 miles west of Fairbanks. The remote facility is accessible only by air or water. The population of the adjacent community of Galena is approximately 300. There are approximately 350 military personnel assigned to the base. Other communities in the area are Ruby and Koyukuk which are 50 miles east and 30 miles west of Galena, respectively. There is no road connecting Galena with these communities. Figure 2.2 shows the Galena vicinity and Figure 2.3 presents the installation site plan. The installation site plans for the various installations show only a few major buildings for orientation purposes.

Campion AFS

Campion AFS is a deactivated LRR site, consisting of 2,395 acres of land. The installation was deactivated in October 1984. It is located 12 miles east of Galena AFS and is accessible by road from Galena (Figures 2.2 and 2.4).

FIGURE 2.1



SOURCE: INSTALLATION DOCUMENTS

FIGURE 2.2

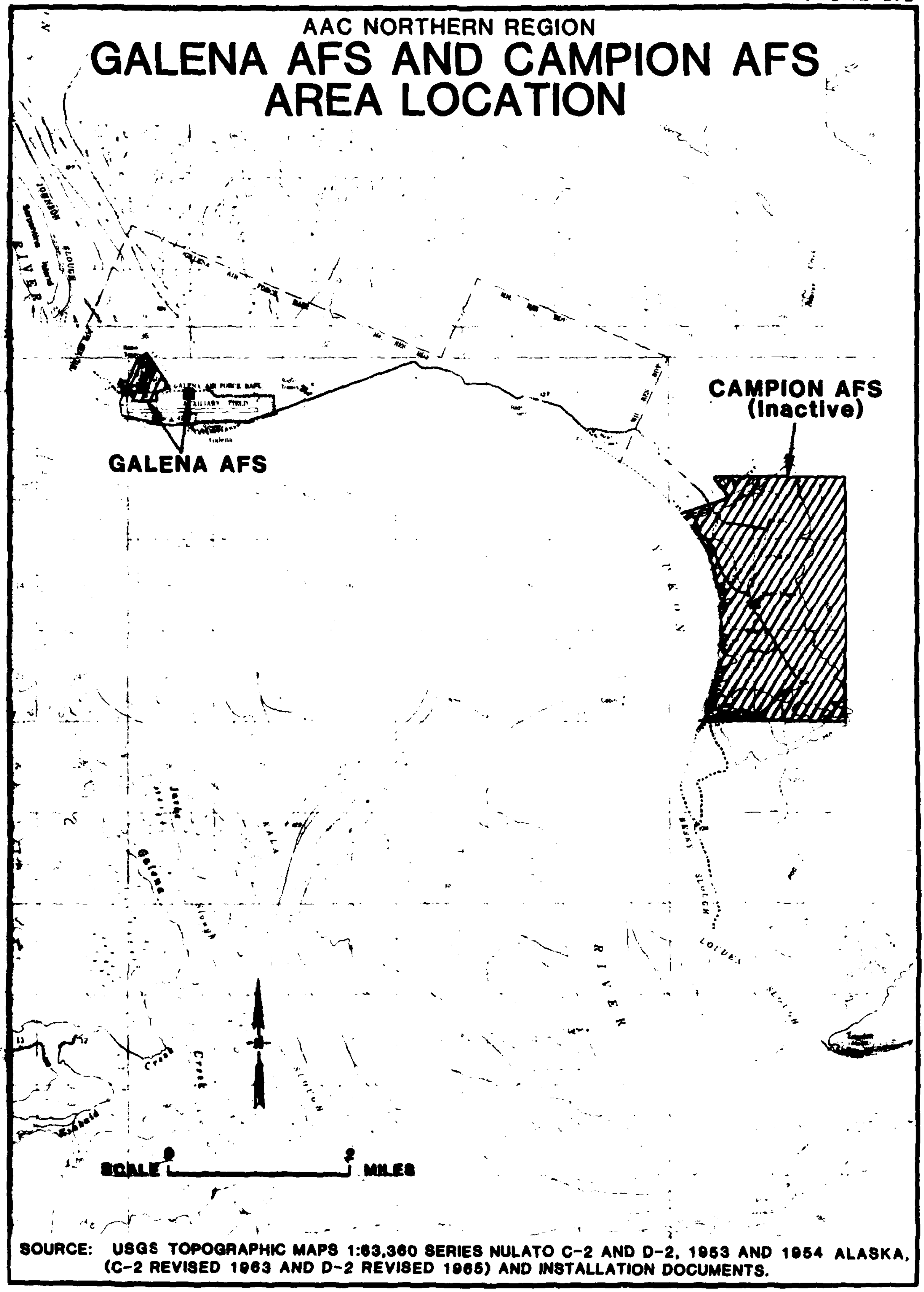
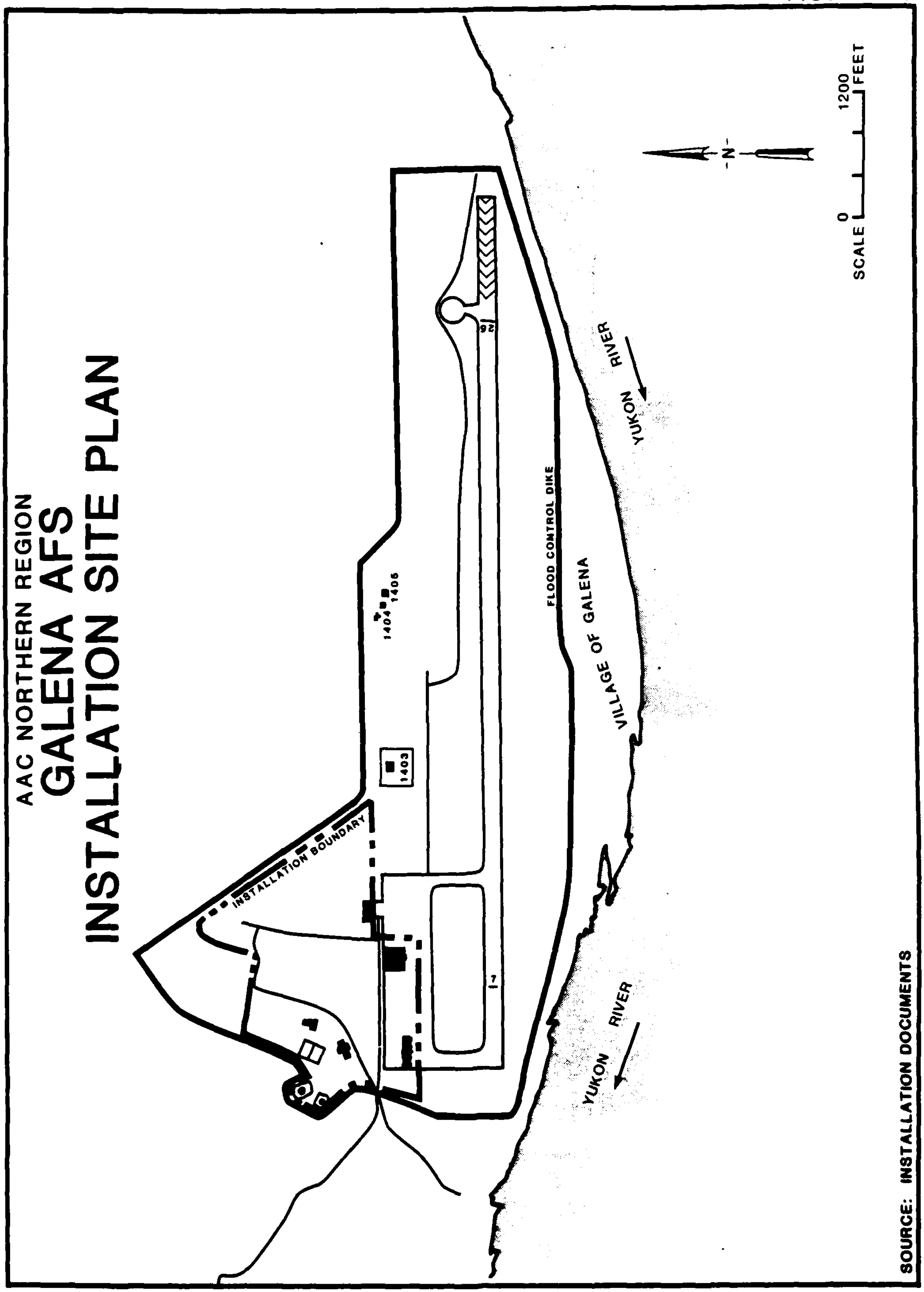
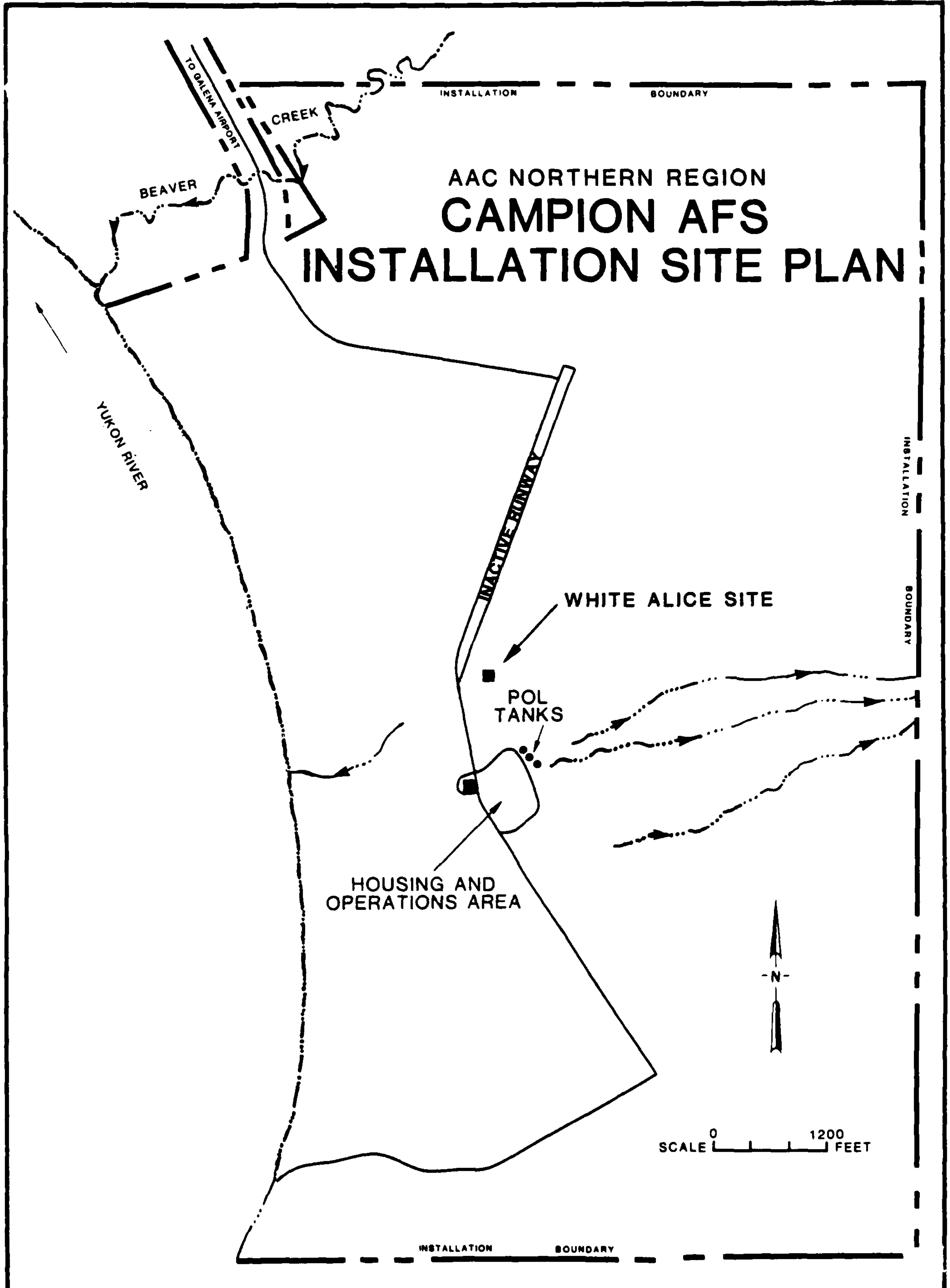

AAC NORTHERN REGION
GALENA AFS AND CAMPION AFS
AREA LOCATION
CAMPION AFS
(Inactive)
GALENA AFS
SCALE
0
2
MILES
SOURCE: USGS TOPOGRAPHIC MAPS 1:63,360 SERIES NULATO C-2 AND D-2, 1953 AND 1954 ALASKA, (C-2 REVISED 1963 AND D-2 REVISED 1965) AND INSTALLATION DOCUMENTS.

FIGURE 2.3



ES ENGINEERING-SCIENCE



SOURCE: INSTALLATION DOCUMENTS

Cape Lisburne AFS

Cape Lisburne AFS consists of 1,125 acres of land along the shore of the Chukchi Sea and within the Alaska Maritime National Wildlife Refuge. The installation is located approximately 810 miles and 570 miles northwest of Anchorage and Fairbanks, respectively. The remote site is accessible only by air or sea. Radar equipment is located at an Upper Camp, and facilities in support of radar operations are located at a Lower Camp. The two camps are connected by a 3.9 mile winding road. Figure 2.5 shows the site vicinity and Figure 2.6 presents the installation site plan. There are currently 14 contractor personnel stationed at the installation. Point Hope is the nearest community, located 35 miles to the southwest. There is no road connecting Point Hope and Cape Lisburne AFS. The population of Point Hope is approximately 400.

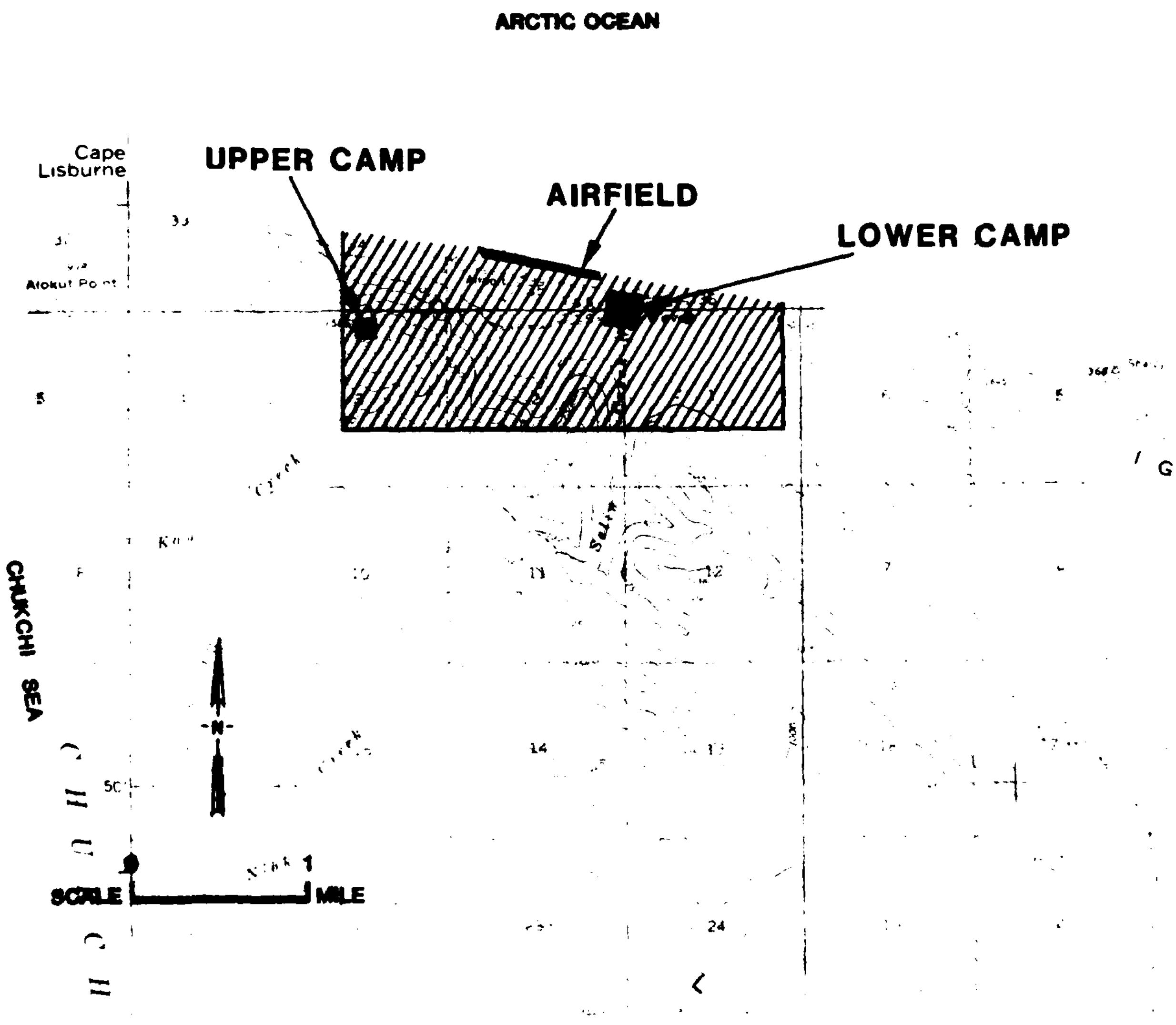
Fort Yukon AFS

Fort Yukon AFS is located along the Yukon River, approximately 440 miles and 140 miles northeast of Anchorage and Fairbanks, respectively. It is reached only by air or water. The installation consists of 326 acres of land within the Yukon Flats National Wildlife Refuge. There are eight contractor personnel assigned to the station. The population of the adjacent community of Fort Yukon is approximately 500. Figures 2.7 and 2.8 show the surrounding area and the installation site plan, respectively.

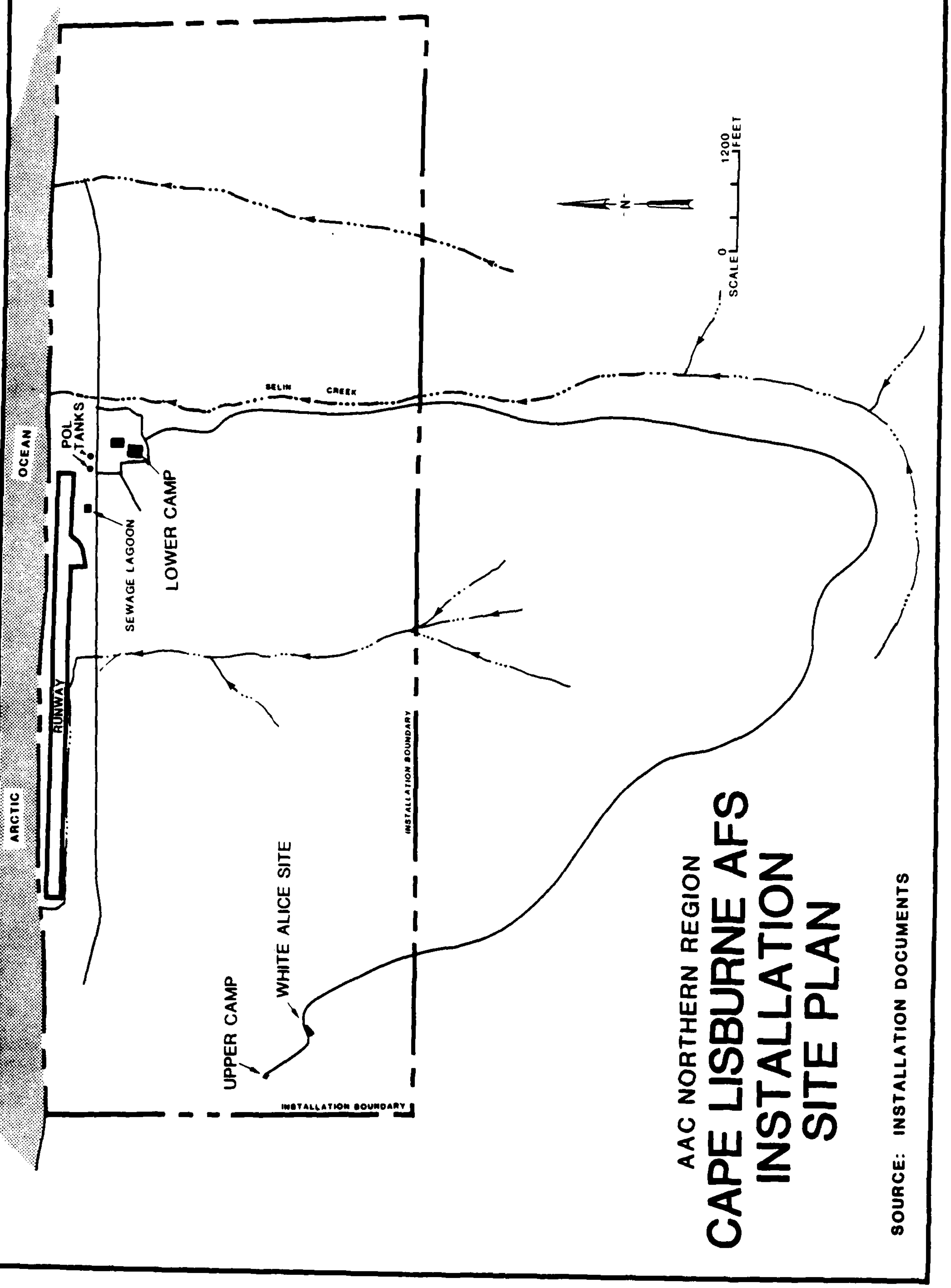
Indian Mountain AFS

Indian Mountain AFS is located 410 miles north of Anchorage and 195 miles northwest of Fairbanks. The remote site is accessible only by air. It consists of 4,226 acres of land, 15 miles east of the community of Hughes (population of approximately 85). There is no road connecting the installation with Hughes. The installation is divided into two main camps connected by an eight-mile winding road (Figure 2.9). The Upper Camp, on the top of Indian Mountain, provides living and working facilities for personnel attending the radar. The Lower Camp, south of the Upper Camp, is located at the confluence of the Indian River and Utopia Creek. The Lower Camp has a runway, power plant, bulk fuel storage and other facilities which support the operations for both camps. A new composite facility with housing and industrial operations was occupied

AAC NORTHERN REGION
CAPE LISBURNE AFS AREA LOCATION



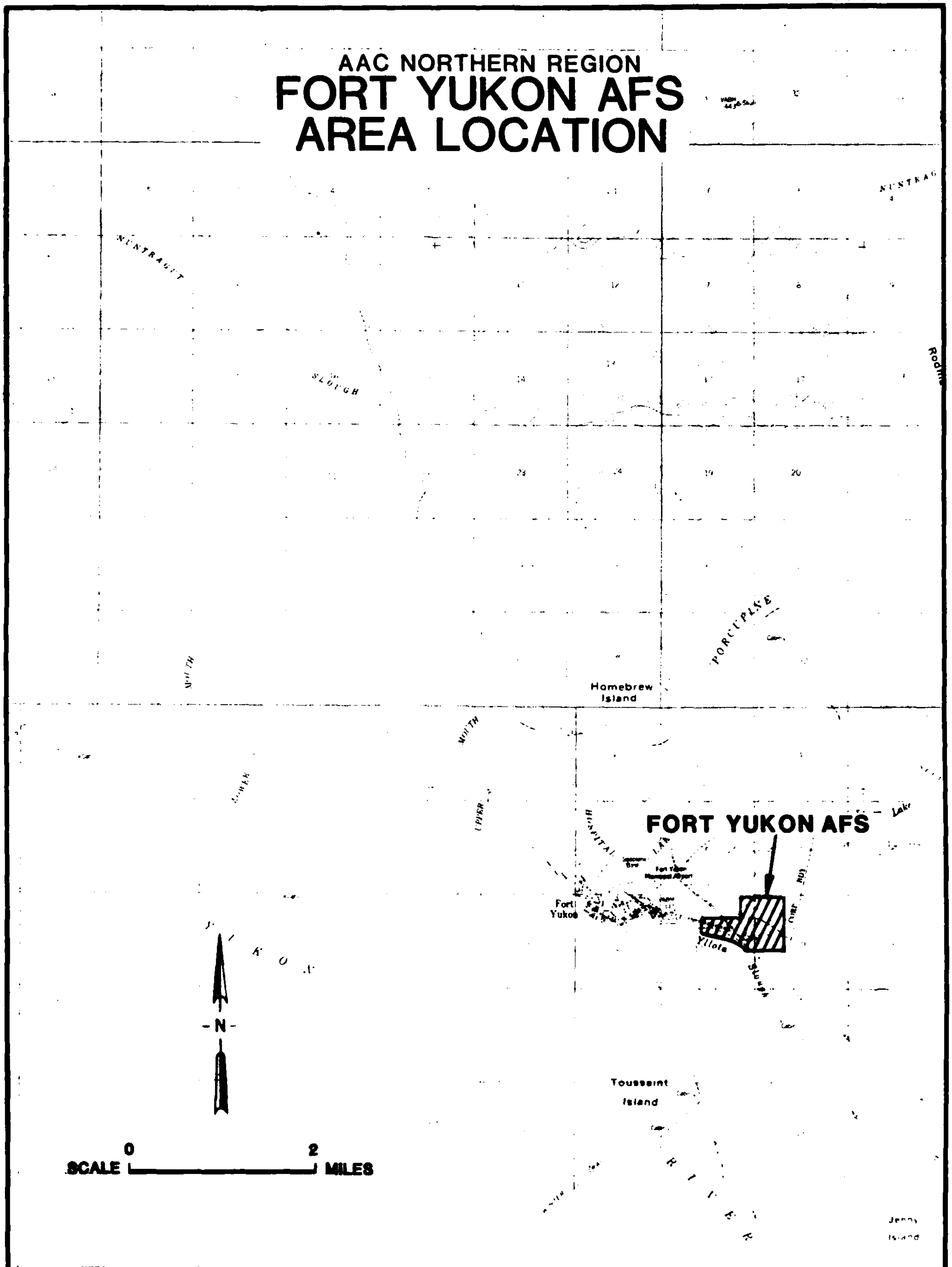
SOURCE: USGS TOPOGRAPHIC MAP 1:63,360 SERIES POINT HOPE D-2, ALASKA, 1952 AND INSTALLATION DOCUMENTS.



AAC NORTHERN REGION
CAPE LISBURNE AFS INSTALLATION SITE PLAN

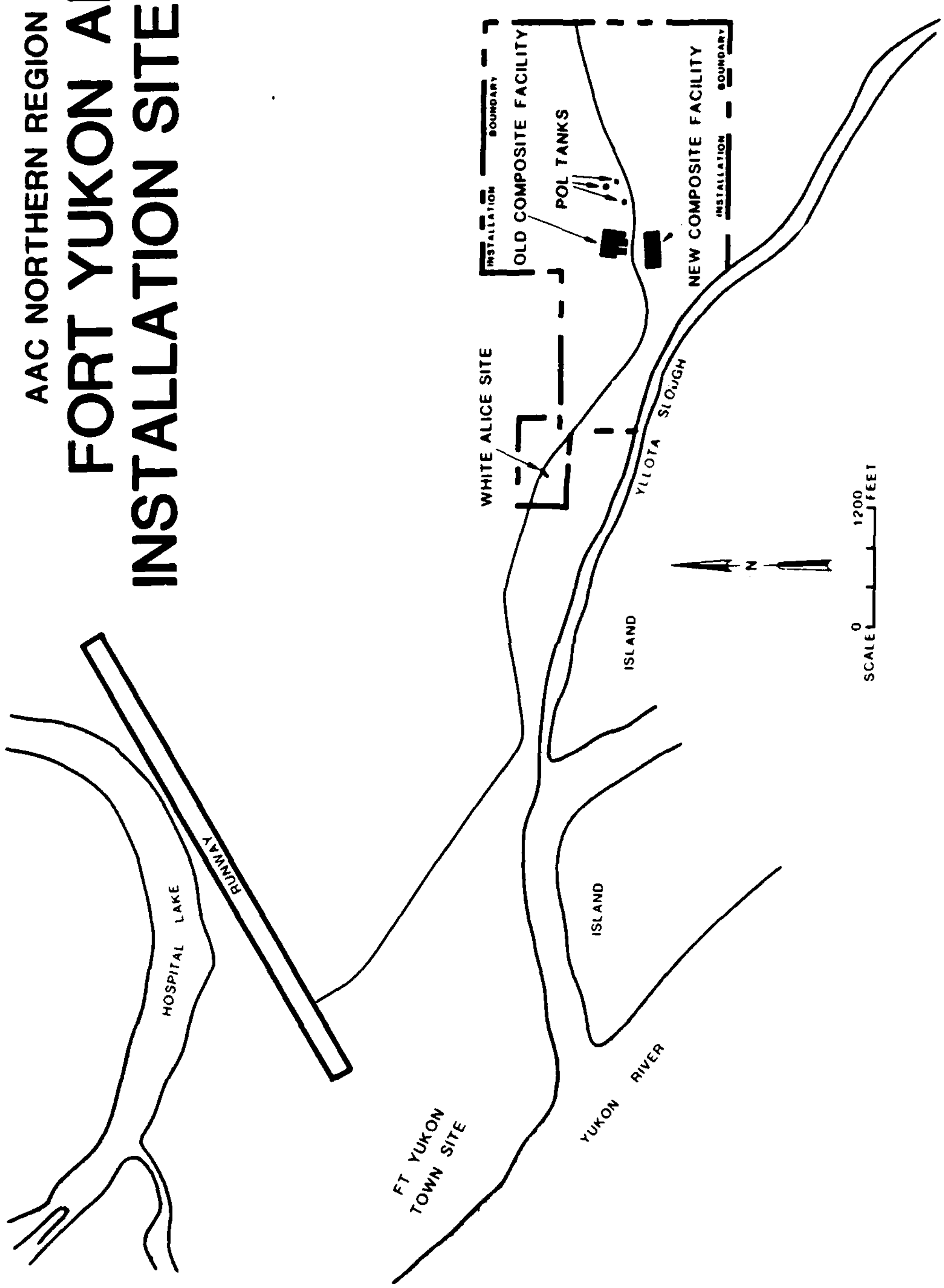
SOURCE: INSTALLATION DOCUMENTS

FIGURE 2.7



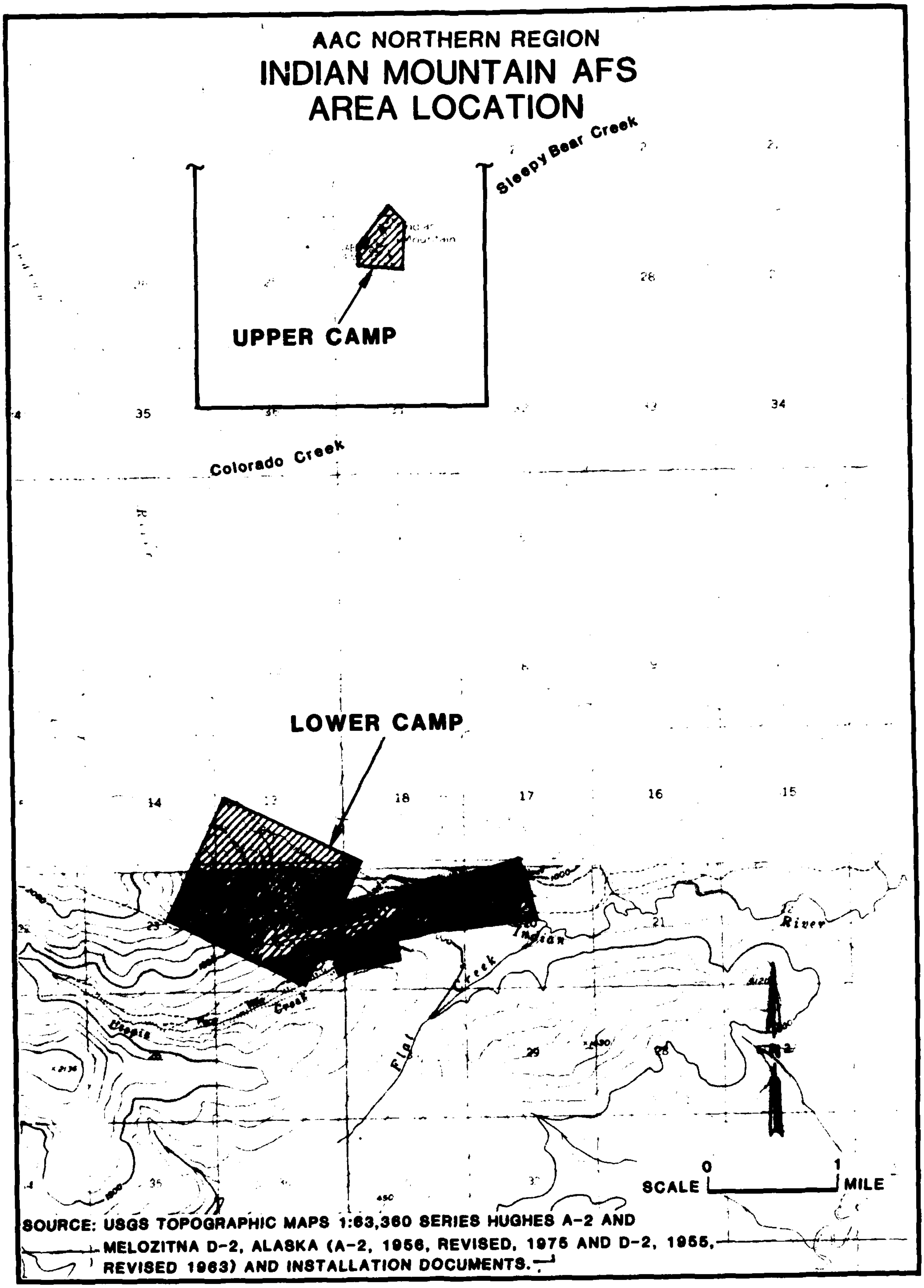
SOURCE: USGS TOPOGRAPHIC MAP 1:63,360 SERIES FORT YUKON C-3, ALASKA, 1955 (REVISED 1974) AND INSTALLATION DOCUMENTS.

AAC NORTHERN REGION
FORT YUKON AFS
INSTALLATION SITE PLAN



SOURCE: INSTALLATION DOCUMENTS

FIGURE 2.9



SOURCE: USGS TOPOGRAPHIC MAPS 1:63,360 SERIES HUGHES A-2 AND MELOZITNA D-2, ALASKA (A-2, 1956, REVISED, 1975 AND D-2, 1955, REVISED 1963) AND INSTALLATION DOCUMENTS.

in 1984 at the Lower Camp (Figure 2.10). Approximately 14 personnel are currently assigned to the station.

Kotzebue AFS

Kotzebue AFS consists of 676 acres of land located on Kotzebue Sound. The installation is located approximately 610 miles northwest of Anchorage and 450 miles west-northwest of Fairbanks. The community of Kotzebue, accessible by road four miles north of the AFS site, has a population of approximately 1,700. Kotzebue can be reached only by air or sea. Except for the radar tower, the site was deactivated in May 1985. The three radar technicians assigned to the installation live in the community of Kotzebue. Figures 2.11 and 2.12 show the site vicinity and installation plan, respectively.

Murphy Dome AFS

Murphy Dome AFS is located 320 miles north of Anchorage and 20 miles northwest of Fairbanks. The site is accessible by road (Highway 2) from Fairbanks. The 846 acre site is situated at the top of Murphy Dome. Figure 2.13 shows the installation vicinity and Figure 2.14 presents the facility site plan. All facilities are at the top of the mountain; no operations are known to have taken place at the Annex. Currently less than ten personnel are assigned to the site operations.

Tin City AFS

Tin City AFS is located approximately 700 miles northwest of Anchorage and 570 miles west-northwest of Fairbanks. It is accessible only by air or sea. The installation consists of 748 acres of land near the end of the Seward Peninsula and adjacent to an Alaska Maritime National Wildlife Refuge. The installation consists of an Upper Camp and Lower Camp (Figure 2.15). The Lower Camp is located 1/2 mile west of the Tin City mine site at the mouth of Cape Creek. The Upper Camp is located west of the Lower Camp on the top of Cape Mountain (Figure 2.16). There are approximately 15 contractor personnel stationed at the installation. The site is five miles southeast of the community of Wales, which has a population of approximately 130. There is no road connecting Tin City AFS and Wales.

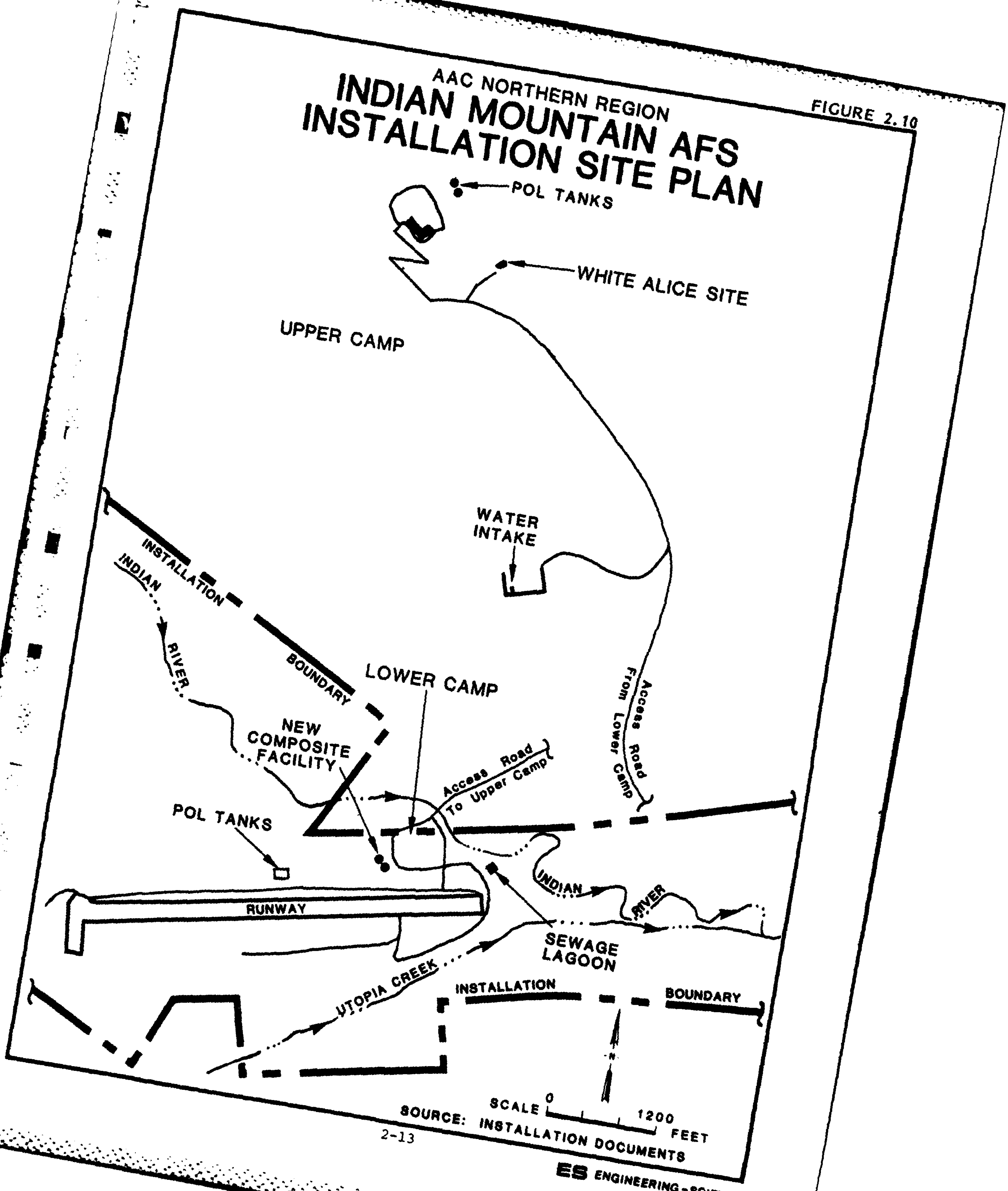
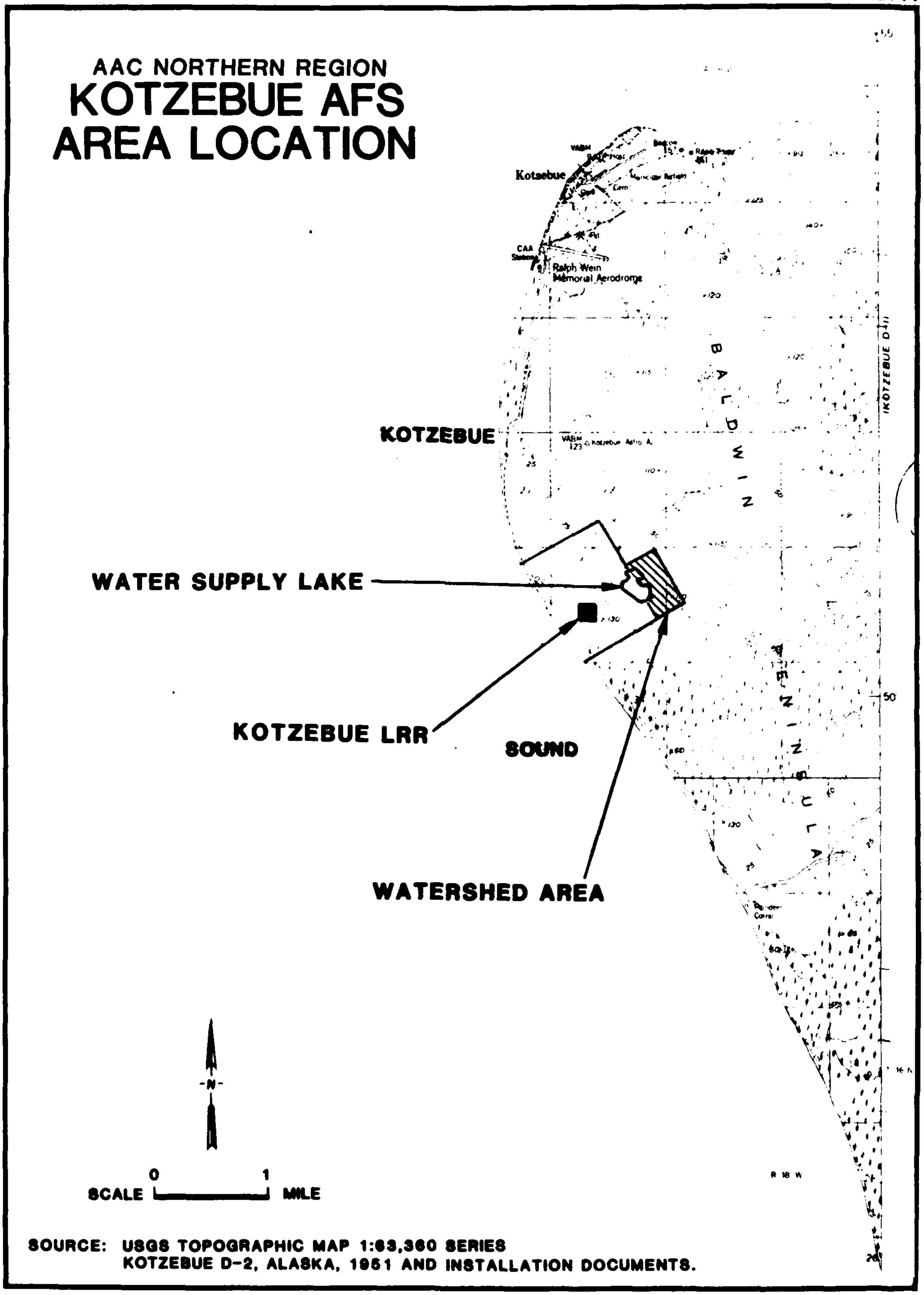
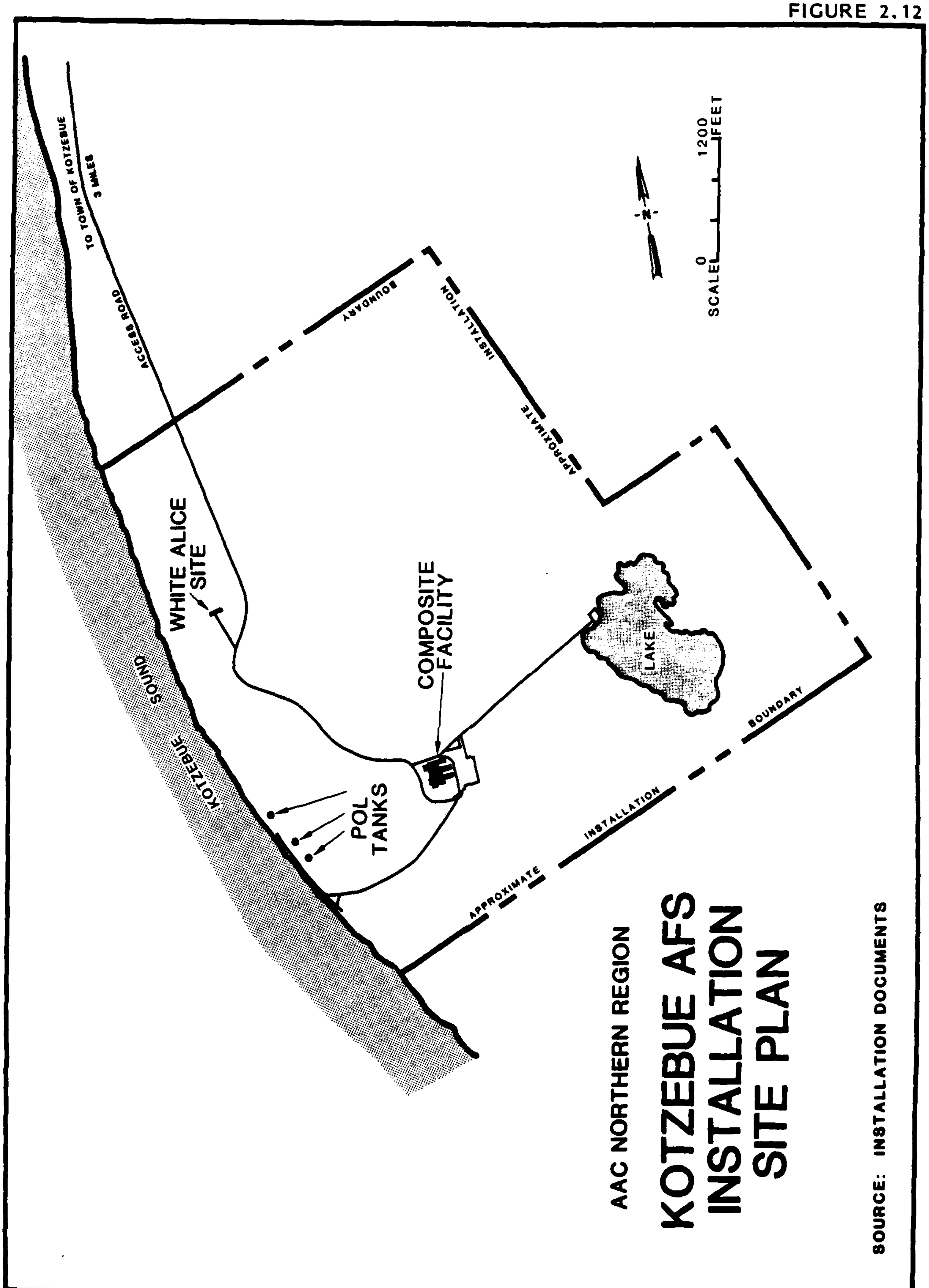

AAC NORTHERN REGION
INDIAN MOUNTAIN AFS
INSTALLATION SITE PLAN
FIGURE 2.10
POL TANKS
WHITE ALICE SITE
UPPER CAMP
WATER INTAKE
INSTALLATION BOUNDARY
INDIAN RIVER
LOWER CAMP
Access Road From Lower Camp
NEW COMPOSITE FACILITY
Access Road To Upper Camp
POL TANKS
RUNWAY
INDIAN RIVER
SEWAGE LAGOON
UTOPIA CREEK
INSTALLATION BOUNDARY
N
SCALE 0 1200 FEET
SOURCE: INSTALLATION DOCUMENTS
ES ENGINEERING-SCIENCE

FIGURE 2.11


AAC NORTHERN REGION
KOTZEBUE AFS
AREA LOCATION
Kotzebue
Ralph Wein Memorial Aerodrome
BALDWIN PENINSULA
KOTZEBUE D-1
KOTZEBUE
WATER SUPPLY LAKE
KOTZEBUE LRR
SOUND
WATERSHED AREA
N
SCALE
0
1
MILE
SOURCE: USGS TOPOGRAPHIC MAP 1:63,360 SERIES
KOTZEBUE D-2, ALASKA, 1951 AND INSTALLATION DOCUMENTS.


AAC NORTHERN REGION
KOTZEBUE AFS
INSTALLATION
SITE PLAN
SOURCE: INSTALLATION DOCUMENTS
TO TOWN OF KOTZEBUE
3 MILES
ACCESS ROAD
APPROXIMATE INSTALLATION BOUNDARY
WHITE ALICE SITE
COMPOSITE FACILITY
LAKE
POL TANKS
KOTZEBUE SOUND
N
SCALE
0
1200
FEET

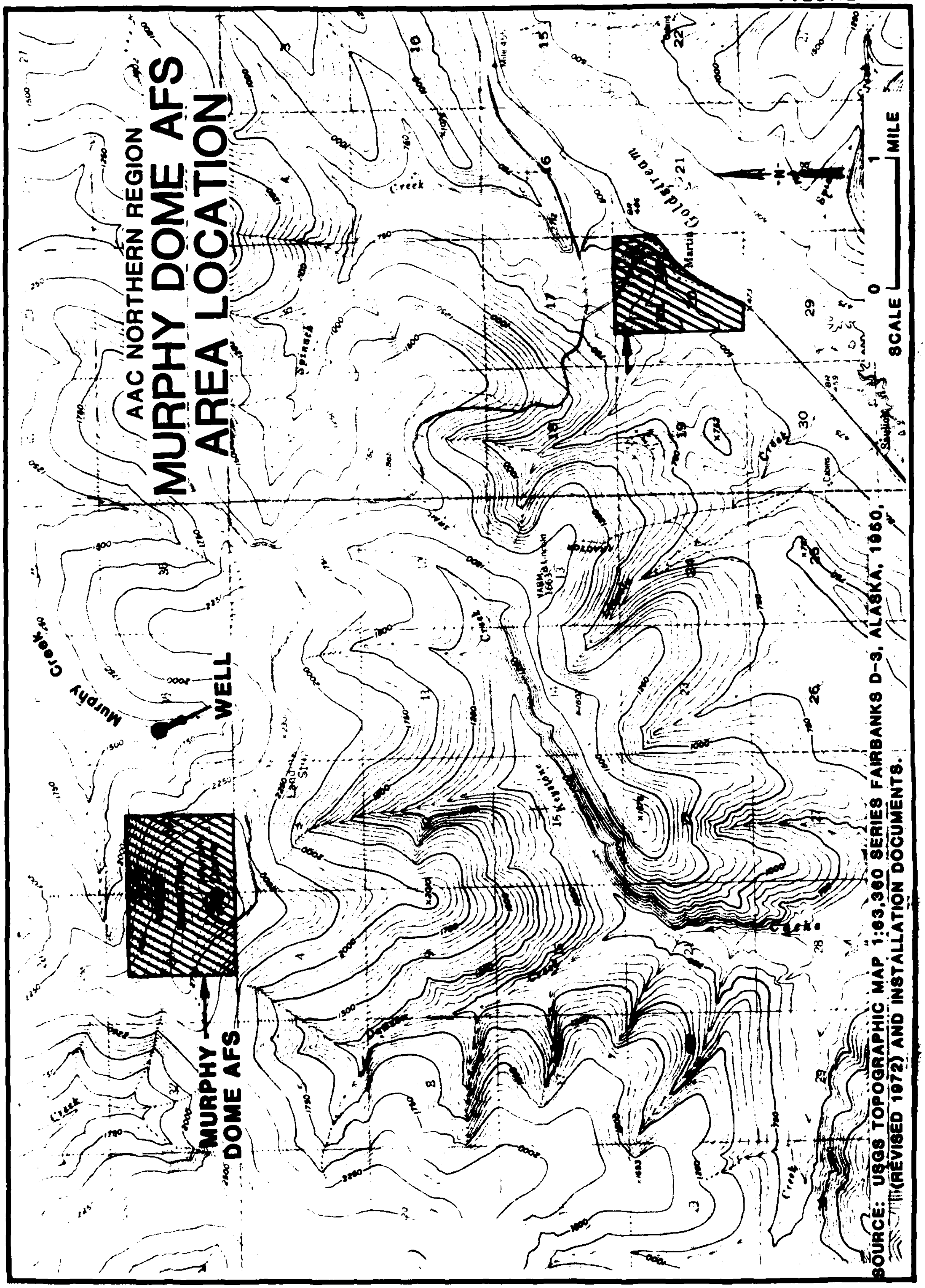
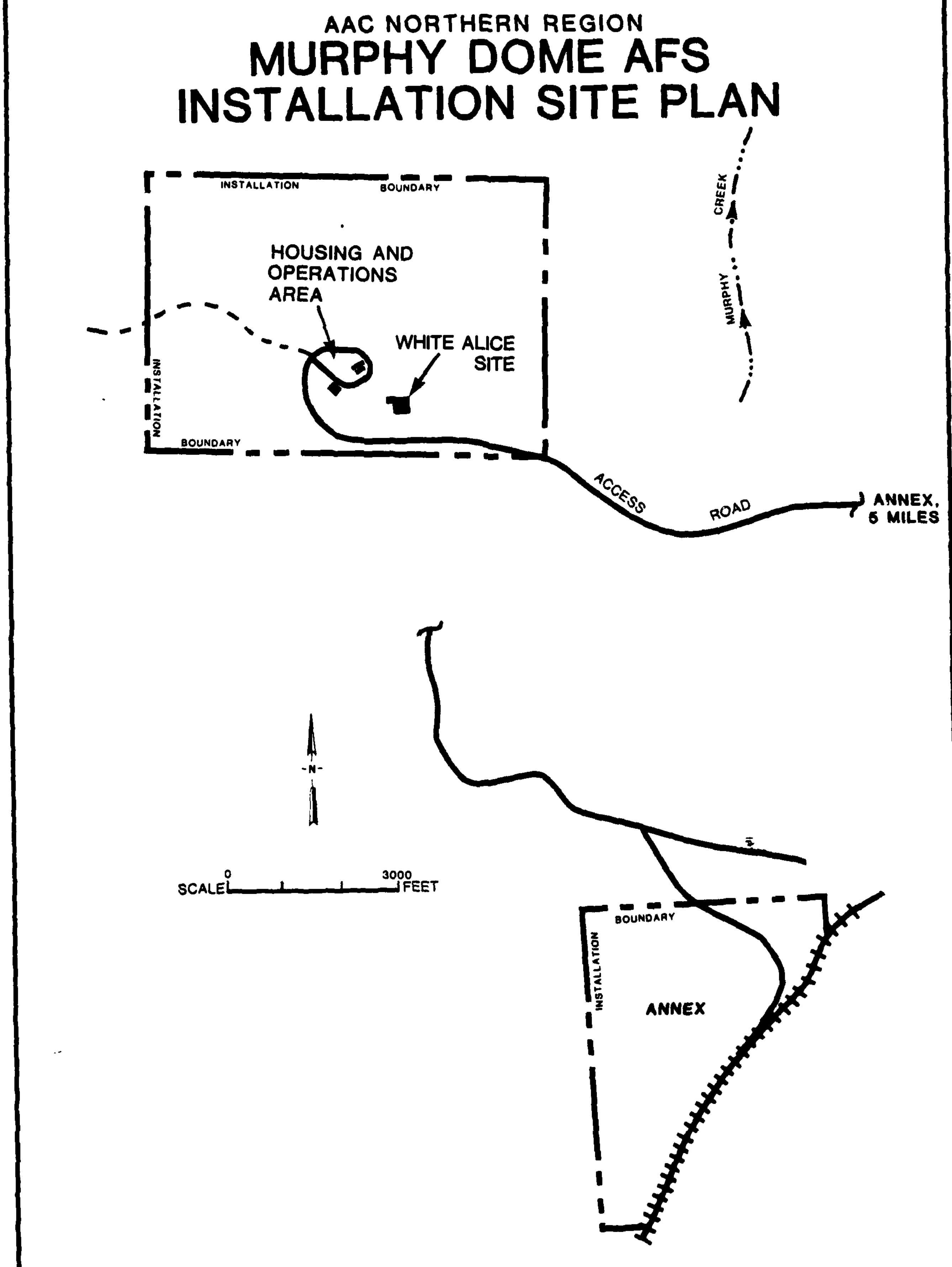
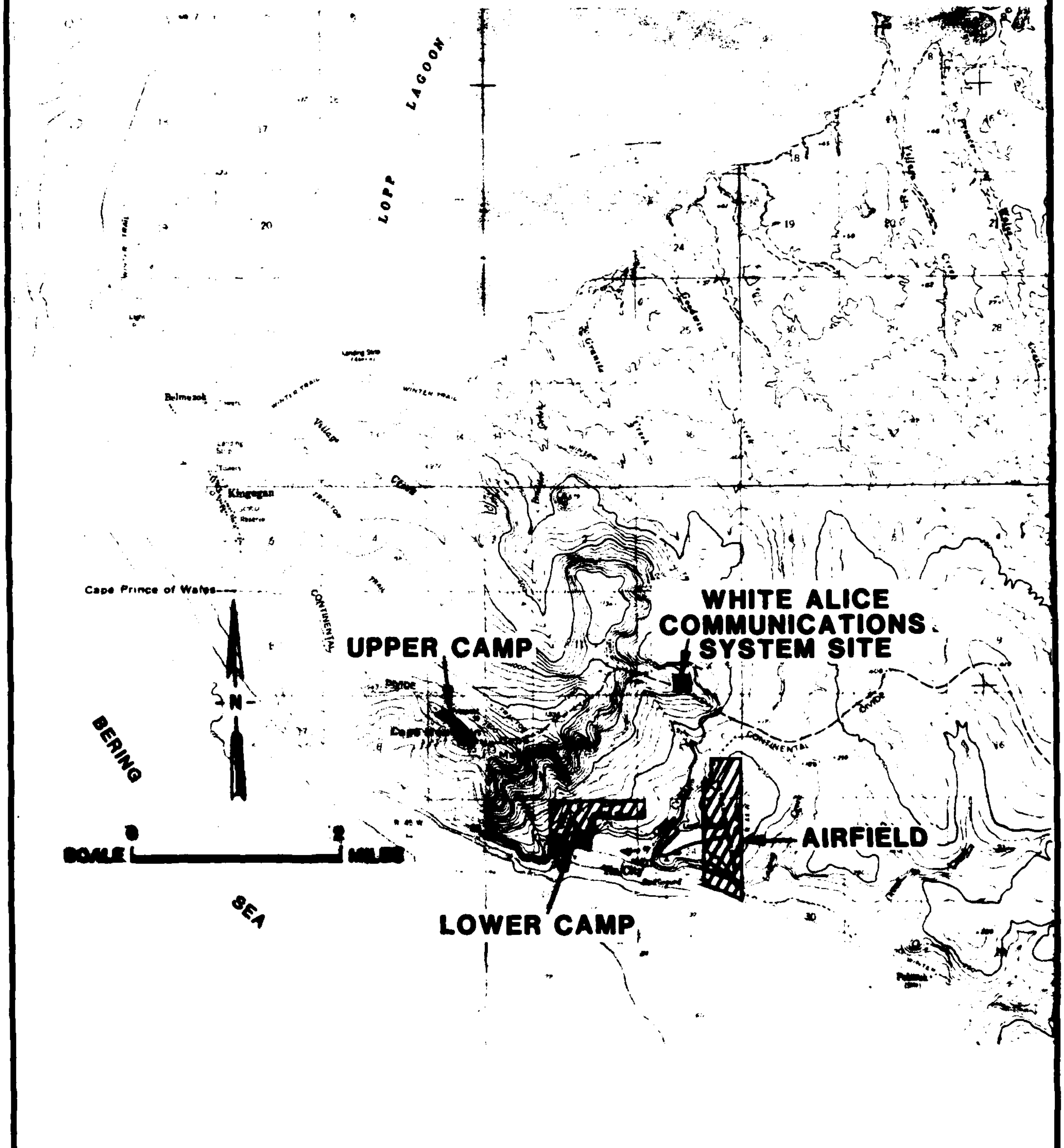

AAC NORTHERN REGION
MURPHY DOME AFS
AREA LOCATION
MURPHY DOME AFS
WELL
Murphy Creek
Goldstream
SCALE
0
1
MILE
SOURCE: USGS TOPOGRAPHIC MAP 1:63,360 SERIES FAIRBANKS D-3, ALASKA, 1950, (REVISED 1972) AND INSTALLATION DOCUMENTS.

FIGURE 2.14



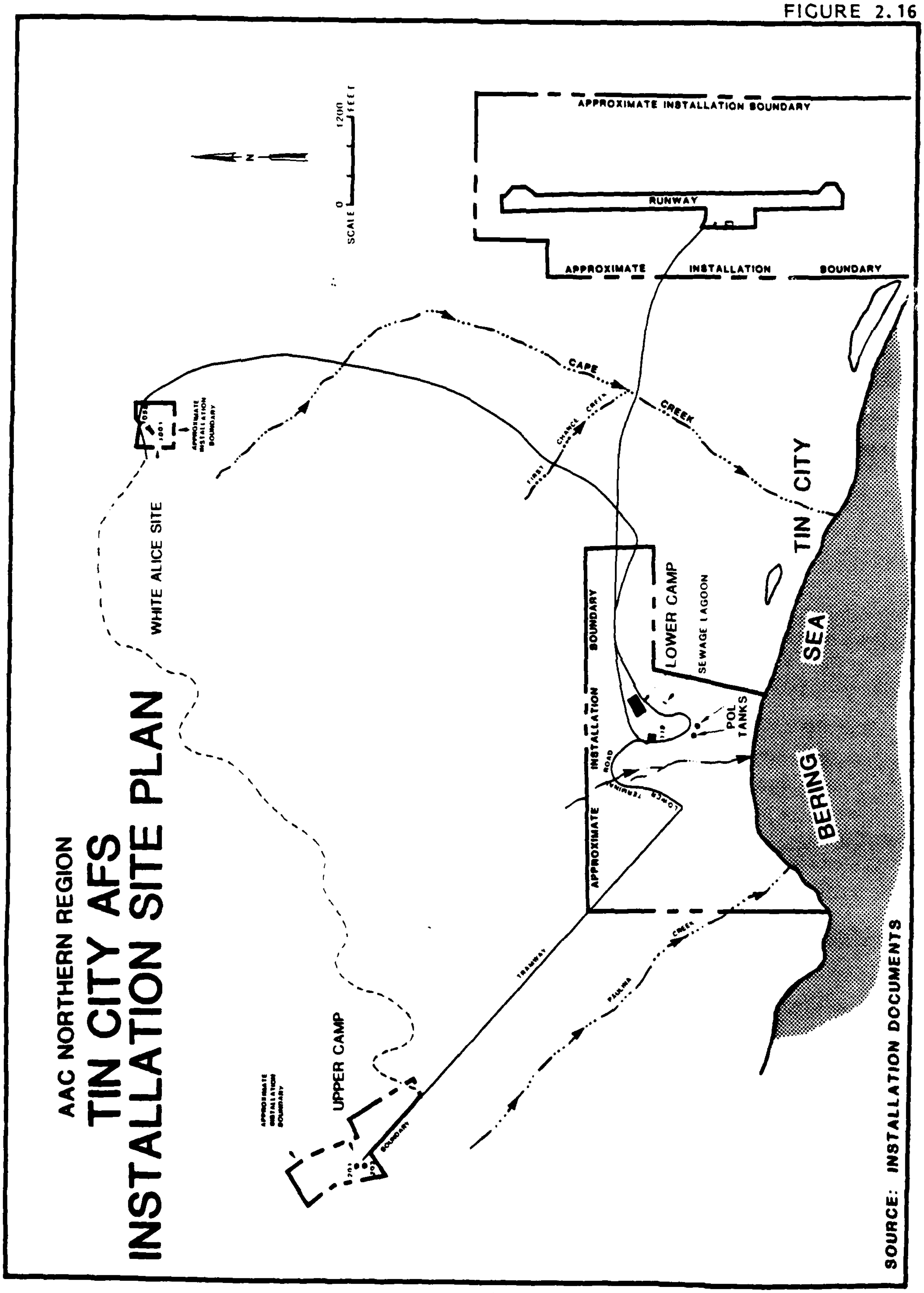
SOURCE: INSTALLATION DOCUMENTS

AAC NORTHERN REGION
TIN CITY AFS AREA LOCATION



SOURCE: USGS TOPOGRAPHIC MAPS 1:63,360 SERIES TELLER C-6 AND C-7, ALASKA, 1950 (C-6 REVISED 1973 AND C-7 REVISED 1974) AND INSTALLATION DOCUMENTS.

FIGURE 2.16


AAC NORTHERN REGION
TIN CITY AFS
INSTALLATION SITE PLAN
SCALE 0 1200 FEET
N
APPROXIMATE INSTALLATION BOUNDARY
RUNWAY
APPROXIMATE INSTALLATION BOUNDARY
CAPE CREEK
FIRST CHANCE CREEK
APPROXIMATE INSTALLATION BOUNDARY
WHITE ALICE SITE
TIN CITY
LOWER CAMP
SEWAGE LAGOON
APPROXIMATE INSTALLATION BOUNDARY
POL TANKS
LOWER TERMINAL ROAD
BERING SEA
TRAMWAY
PAULINA CREEK
UPPER CAMP
APPROXIMATE INSTALLATION BOUNDARY
BOUNDARY
SOURCE: INSTALLATION DOCUMENTS

INSTALLATION HISTORY

Galena AFS

In 1941, the Civil Aviation Administration (now the Federal Aviation Administration [FAA]) constructed an airfield at Galena to satisfy the need for an operational airfield in the area. During World War II, Galena Airport was a satellite field of Fort Wainwright in Fairbanks. Galena was an active refueling stop for Alaska to Siberia ferrying operations throughout the war. Soviet aircraft operated at Galena during the war under the Lend-Lease Program. The Army returned the airfield to the FAA after World War II. The FAA administered Galena as a civil airport until the Korean War. Galena remained under the FAA's control and custody after the Korean War. In 1959 the airport was transferred to the State of Alaska. Galena has served as a forward operating base since 1951. Aircraft constantly on alert at Galena AFS, as part of the AAC's air defense mission, are supported by personnel and equipment located at the installation.

Campion AFS

Campion AFS was one of the ten original aircraft control and warning (AC&W) sites constructed as part of the establishment of a permanent air defense system in Alaska during the early 1950's. Construction of the installation was completed in 1951. Campion became operational as a ground controlled intercept site in 1952. During the first half of 1953, Campion was changed from a ground controlled intercept site to an air defense direction center (later North American Air Defense Command [NORAD] Control Center). Campion reverted back to a ground controlled intercept site in 1973.

Communications were provided by a high frequency radio system until 1958 when the radio system was replaced by the White Alice Communications System (WACS), a system of tropospheric and microwave relay sites. The White Alice site was deactivated in 1978 as part of an overall program to replace the government-owned, contractor-operated system with a commercially owned and operated satellite communications system (Alascom).

In 1977, the AAC implemented a site support contract with RCA Services as part of an Air Force-wide effort to reduce remote tours. Seventy-six military positions were eliminated. The remaining 32 were

primarily operations personnel. Installation of Joint Surveillance System (JSS) equipment was completed in 1982, enabling radar and beacon data to be transmitted via satellite to the Region Operations Control Center (ROCC) at Elmendorf AFB in Anchorage. The ROCC achieved operational capability in 1983 and the AC&W operation was inactivated. This left only contractor personnel to maintain the site radar. In 1984, a Minimally Attended Radar (MAR) was installed at the nearby Galena AFS and Campion AFS was deactivated. Structures at Campion are currently being dismantled.

Cape Lisburne AFS

Cape Lisburne AFS was one of the ten original AC&W sites built in the early 1950's to establish an air defense system in Alaska. Construction of the installation was completed in 1952 and it became operational in 1953.

Communications were initially provided by high frequency radio. A WACS site replaced the radio communications in 1957. In 1979 the WACS was deactivated and replaced with an Alascom-owned satellite earth terminal.

In 1977, the AAC implemented a site support contract with RCA Services which resulted in the elimination of 79 military positions at Cape Lisburne. The remaining 14 positions were primarily in operations. A JSS was installed in 1982, enabling radar and beacon data to be transmitted via satellite to the Elmendorf ROCC. After 1983 only contractor personnel remained at the site to maintain the radar. In 1985, a MAR unit was installed which will enable further staff reduction.

Fort Yukon AFS

During the 1950's, AAC began building a permanent air defense system in Alaska. The initial system included five coastal surveillance sites and five ground controlled intercept sites. AAC later expanded the radar coverage north and south of the original sites and one of the two northern sites selected was Fort Yukon. In 1958 the installation construction was completed and it became operational as a ground controlled intercept site in 1958.

Communications were provided by the WACS until it was deactivated in 1980 and replaced with an Alascom-owned satellite earth terminal.

A contract with RCA Services in 1977 to provide support services at the site eliminated 69 military positions. The remaining 27 were primarily in operations. In 1982 a JSS was completed and the military AC&W operation was inactivated. In 1984 MAR equipment was installed which further reduced support staff.

Indian Mountain AFS

The Indian Mountain AFS site was selected as an additional AC&W site after the initial ten sites were authorized in the early 1950's. Construction was finished at Indian Mountain in 1953 and it became operational shortly thereafter.

The original high frequency radio communication system used for the installation was replaced in 1958 by the WACS. In 1979, a commercially owned and operated (Alascom) satellite earth terminal replaced the White Alice System.

In 1977, AAC contracted with RCA Services to provide support at the site. This eliminated 103 military positions leaving 27 primarily in operation. A JSS, installed in 1982, enabled radar and beacon data to be transmitted via satellite to the Elmendorf ROCC. This eliminated military operations at the facility and left only contractor personnel. In 1984 the personnel levels were further reduced when a MAR unit became operational.

Kotzebue AFS

Kotzebue AFS was originally built as a temporary AC&W site to fill a radar coverage gap while two permanent sites were being built at Cape Lisburne and Tin City. Kotzebue AFS was equipped with a lightweight search radar when it first became operational in 1950. In 1954, the AAC decided to convert the site to a permanent station. Construction of the facilities was completed in 1958. Kotzebue operated as a ground controlled intercept site until 1973 when it was converted to a NORAD surveillance station.

Communications for Kotzebue AFS were provided by the WACS from 1957 until 1979 when a commercial satellite earth station replaced it.

In 1977, AAC signed a base operating support contract with RCA Services as part of an Air Force-wide effort to reduce remote tours. Sixty-nine military positions were eliminated and 16 operations positions remained. Installation of JSS equipment was completed in 1982,

enabling radar and beacon data to be transmitted via satellite to the Elmendorf ROCC. This left only contractor personnel to maintain the radar. A MAR system was installed in 1985 which enabled deactivating the site, with the exception of the radome. Radar maintenance technicians are currently housed in the nearby community of Kotzebue.

Murphy Dome AFS

Murphy Dome AFS was one of the original ten AC&W sites constructed in Alaska in the early 1950's. Facility construction was completed in 1951 and the site became operational in 1952.

In 1977, a contract with RCA Services enabled eliminating 88 military positions and leaving 66 personnel primary in operations. The JSS equipment, which enabled radar and beacon data to be transmitted by satellite to the Elmendorf ROCC, became operational in 1983. This eliminated military operations at the site leaving only contractor personnel.

Tin City AFS

Tin City AFS was one of the ten original sites constructed air defense system in Alaska during the early 1950's. Tin City AFS became operational as a coastal surveillance site in 1953.

Communications were initially provided by high frequency radio and subsequently in 1958 by a WACS. The White Alice site was deactivated in 1975 and replaced with an Alascom-owned satellite earth terminal.

In 1977, AAC implemented a site support contract with RCA Services. This resulted in the elimination of eighty-one military positions, leaving 14 positions in operation. Installation of the JSS, completed in 1982, enabled radar and beacon data to be transmitted via satellite to the Elmendorf ROCC. This eliminated the military AC&W operations and left only contractor personnel at the installation to maintain the site radar. In 1984 a MAR unit was installed to further reduce personnel requirements at the site.

ORGANIZATION AND MISSION

Galena AFS

The AAC's 21st Tactical Fighter Wing (TFW) at Elmendorf AFB has operational control of Galena Airport. The 5072nd Air Base Squadron (ABS) is the host unit for Air Force operations at Galena Airport.

Weapons loading and aircraft maintenance crews support the aircraft deployed to the Squadron from the 21st TFW and keep the equipment operationally ready and armed for emergencies. Supporting the 5072nd ABS and its mission are four tenant units: Detachment 4, 1931st Information Squadron, 616th Aerial Port Squadron, 11th Weather Squadron and the 11th Tactical Control Group.

Campion AFS

There is currently no active mission at Campion AFS. The installation has been deactivated and the facilities are being disassembled and demolished. The radar operations formerly conducted at the installation have been moved to Galena AFS. The installation mission was identical to that of the other LRR sites included in this study.

Cape Lisburne AFS, Fort Yukon AFS, Indian Mountain AFS, Kotzebue AFS, Murphy Dome AFS and Tin City AFS

The mission of the LRR installations is to maintain readiness as a NORAD Surveillance Station (NSS), to maintain operational readiness as a Forward Air Control Post (FACP) in the Alaskan Tactical Air Control System (TACS) and to operate and maintain an Air Force Station. The installations are subordinate to the 11th Tactical Control Group (TCG) which is headquartered at Elmendorf AFB. The 11th TCG reports to Headquarters, Alaska Air Command. RCA Operations and Maintenance Service has contracted to perform all necessary functions at these installations, including operation and maintenance of the site radar, power/heating plants, electronic communications equipment, vehicles and related support facilities. Other functions include weather observation, supply, medical, food, fire protection and administration.

SECTION 3

ENVIRONMENTAL SETTING

The environmental settings of the Alaskan Air Command (AAC) Northern Region installations are described in this section with the primary emphasis directed toward the identification of features or conditions that may facilitate the migration of hazardous waste contaminants. Environmentally sensitive conditions pertinent to the study are summarized at the end of this section. This section includes site-specific discussions of the natural properties of each installation.

METEOROLOGY

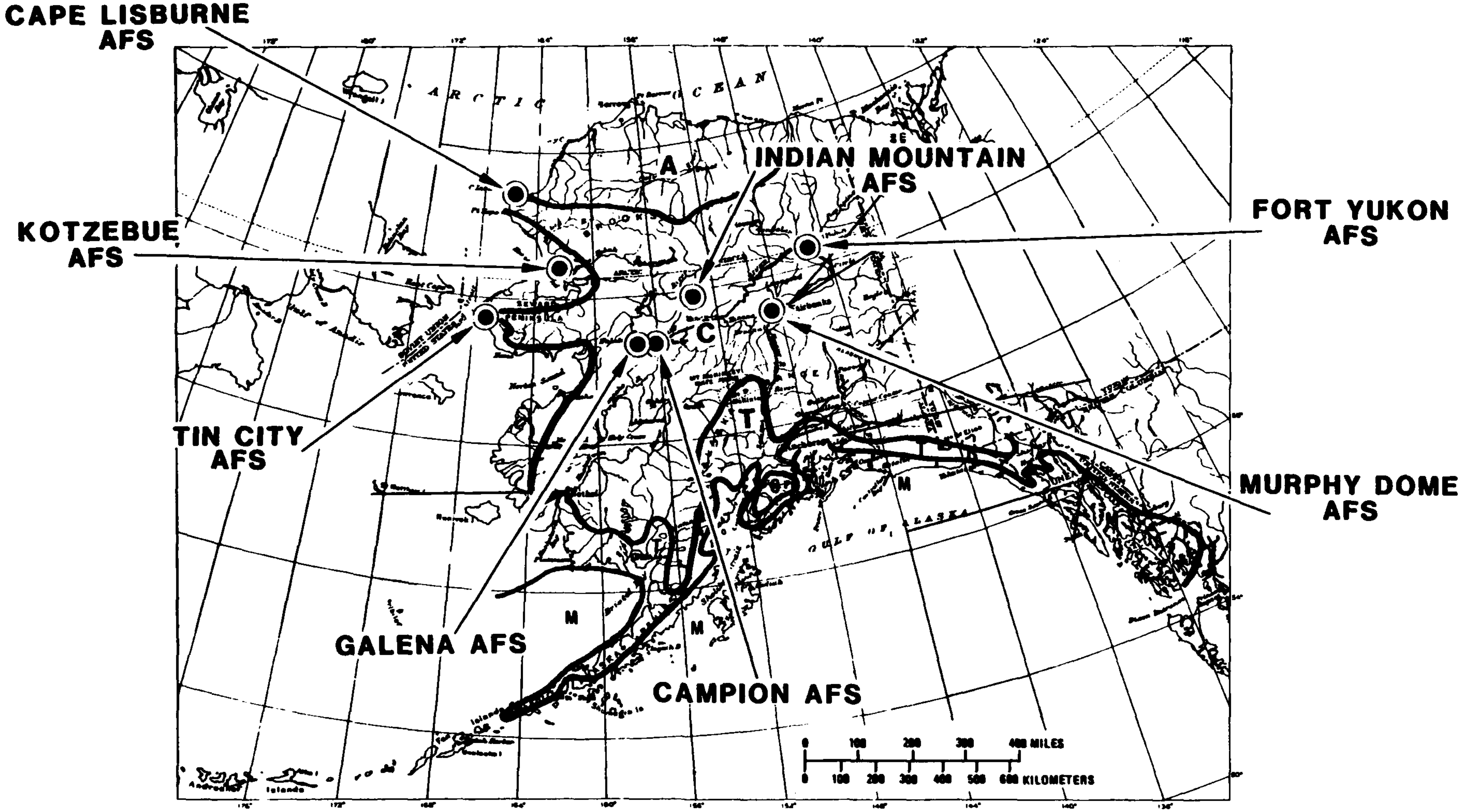
Due to its size and geographic complexity, the State of Alaska encompasses four major climatic zones which have been established on the basis of similar temperature and precipitation values. Figure 3.1 depicts the distribution of the Alaskan climatic zones relative to the installations included within the scope of this study. Rainfall is highly variable across Alaska, ranging from five inches annually in the arctic climatic zone to some 300 inches annually along the southeast coast in the maritime zone (NOAA, 1983 and Zenone and Anderson, 1978). The dramatic variation in rainfall is caused by orographic effects related to topography and exposure: coastal mountain ranges usually receive the most rainfall while interior lowlands tend to receive the least.

Table 3.1 summarizes the generalized climatic conditions for the AAC Northern installations. The site-specific installation climatic data are included in Appendix D. Mean annual precipitation varies from a low of 6.9 inches at Fort Yukon AFS (interior lowland location) to 19.4 inches at Indian Mountain AFS and Tin City AFS (coastal mountain location). The maximum 24-hour precipitation value ranges from 1.5 inches at Fort Yukon AFS to 3.4 inches at Murphy Dome AFS.

No values describing local annual infiltration rates have been published for the subject sites. Also, no evapotranspiration data have

AAC NORTHERN REGION

ALASKAN CLIMATIC ZONES



A REPRESENTS ARCTIC; C, CONTINENTAL; T, TRANSITIONAL; AND M, MARITIME.

SOURCE: MODIFIED FROM ZENONE AND ANDERSON, 1978

TABLE 3.1
SUMMARY OF INSTALLATION CLIMATIC DATA

Installation	Period of Record	Mean Annual Temperature (°F)	Mean Annual Precipitation (Inches)	Maximum 24-Hour Precipitation (Inches)	Annual Surface Winds (Knots)
Galena AFS	1953-1982	24	13.1	1.6	North 4
Campion AFS	1953-1982	24	13.1	1.6	North 4
Cape Lisburne AFS	1953-1982	18	12.3	1.8	East 9
Fort Yukon AFS	1948-1963	20*	6.9	1.5	Northeast 7
Indian Mountain AFS	1959-1982	24	19.4	3.3	East northeast 4
Kotzebue AFS	1931-1970	20.5*	8.3	1.8	East southeast 11
Murphy Dome AFS	1948-1970	26	10.9	3.4	North 4
Tin City AFS	1953-1970	20*	19.4	2.2	North 15

*Calculated from AWS Climatic Brief

Source: 11th Weather Squadron, Elmendorf AFS, Alaska

been reported for the facilities which would permit calculation of net precipitation figures (net precipitation is the amount of precipitation available for infiltration).

GEOGRAPHY

The eight Air Force facilities included in the AAC Northern Region Phase I IRP are distributed over the northern tier of Alaska which is roughly delineated by the course of the Yukon River. These facilities are located within the defined limits of five major Alaskan Physiographic Provinces, each possessing its own unique features and topography. Figure 3.2 depicts the Physiographic Divisions of Alaska. Geologic processes, glaciation and modern erosional effects have sculpted the land surface through time to create the state's landscape. The principal physiographic features, topography and permafrost information relative to the facilities included within this study are listed in Table 3.2. Installation topographic and local relief data are based on elevations expressed in feet. Two datum planes are used: National Geodetic Vertical Datum of 1929 (NGVD) or Mean Sea Level (MSL). More detailed information is presented in references listed in Appendix J.

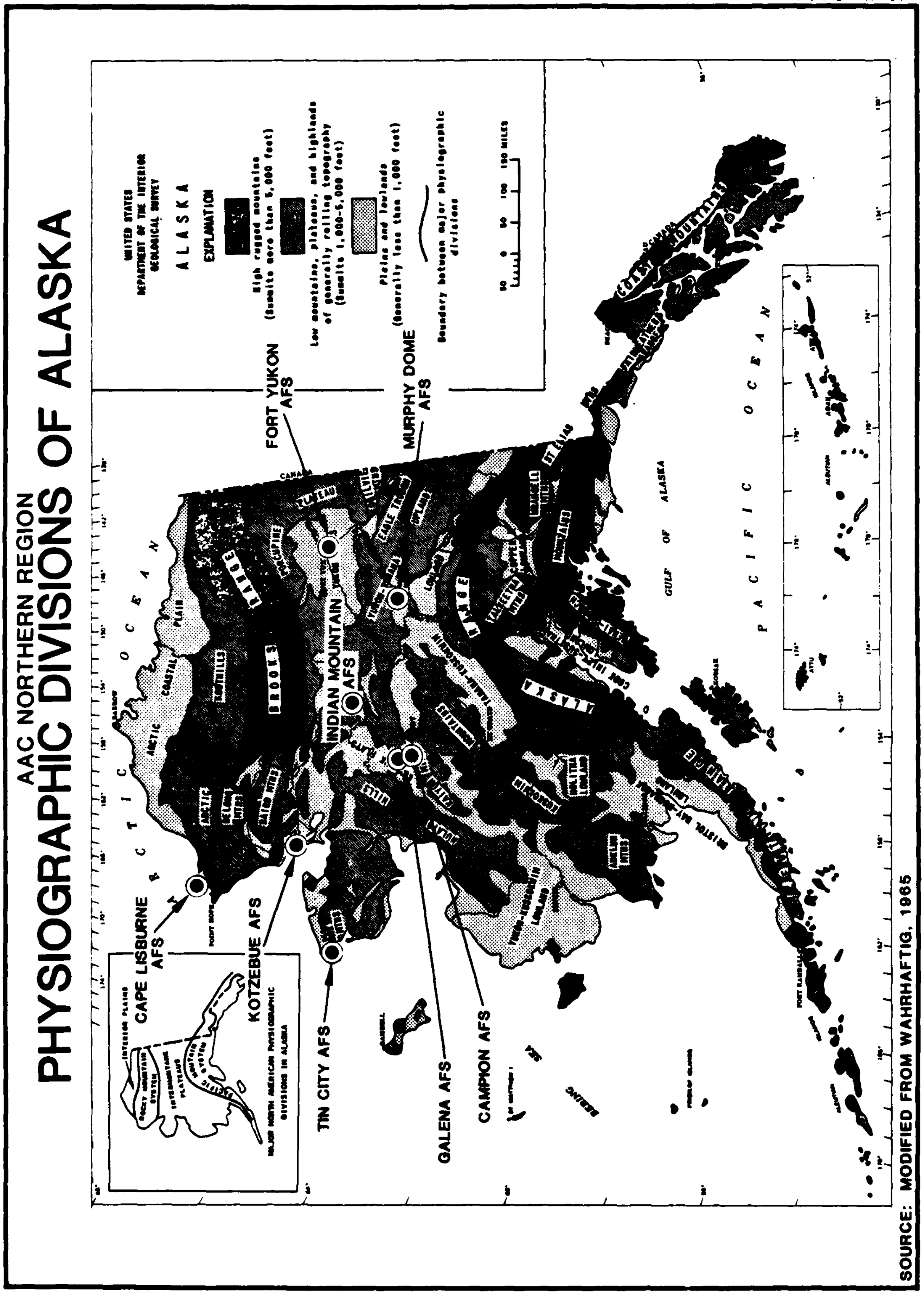
Drainage

Surface water hydrology and surface drainage information was obtained from installation documents; U. S. Geological Survey (USGS) topographic maps; Feulner, et al. (1971); Childers, et al. (1979) and Environmental Systems Corporation (1981).

The surface drainage of runoff originating on the eight USAF installations included within this study is primarily accomplished by overland flow to diversion structures (ditches, swales, drainage systems, etc.) and then to local streams. The surface drainage characteristics of the installations are depicted in the following figures:

Figure 3.3 Galena AFS Drainage
Figure 3.4 Campion AFS Drainage
Figure 3.5 Cape Lisburne AFS Drainage
Figure 3.6 Fort Yukon AFS Drainage
Figure 3.7 Indian Mountain AFS Drainage

FIGURE 3.2



SOURCE: MODIFIED FROM WAHRHAFTIG, 1965

TABLE 3.2
SUMMARY OF INSTALLATION PHYSIOGRAPHIC FEATURES

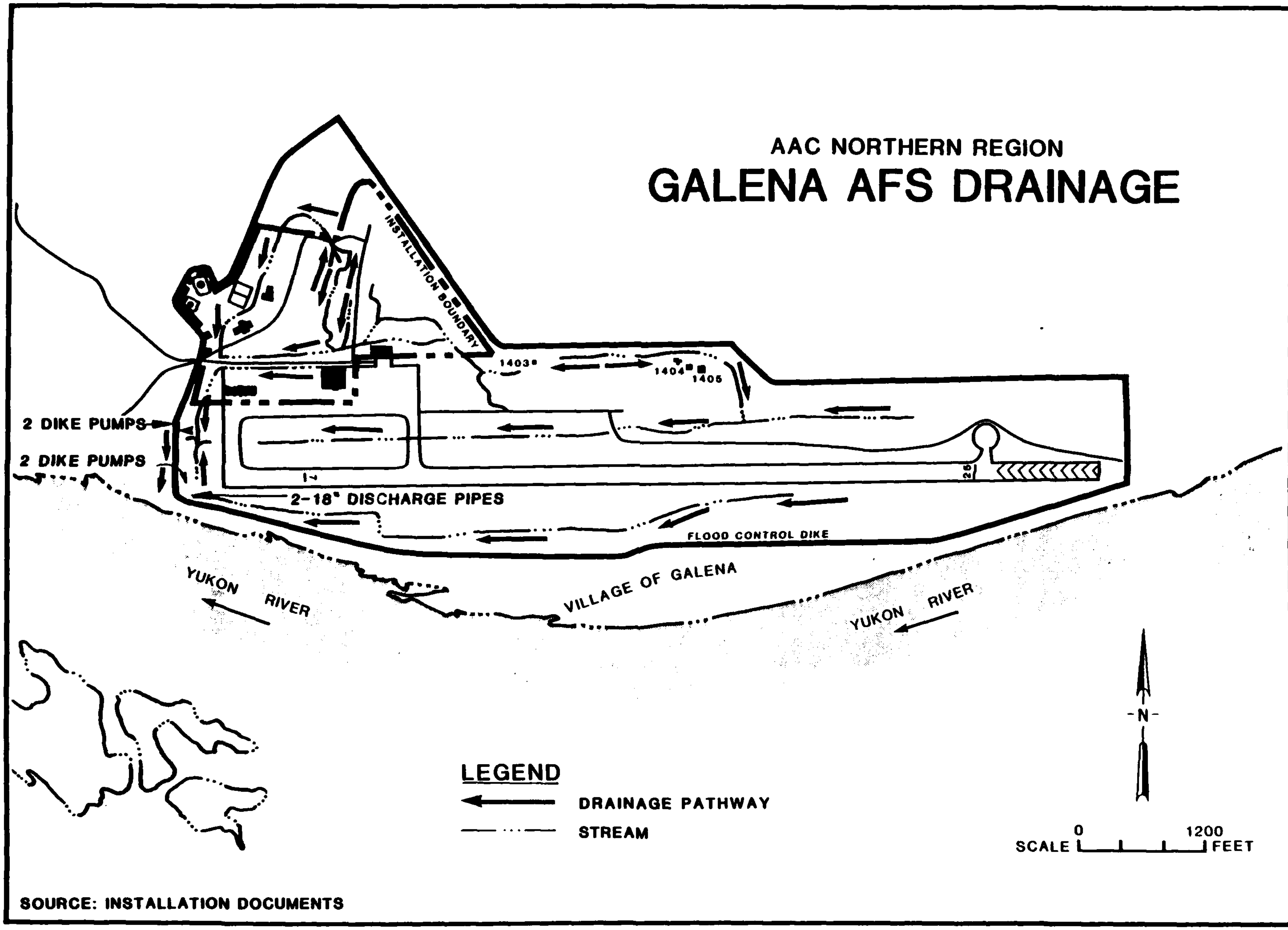
Installation	Alaskan Physiographic Province	Section	Principal Physiographic Features	Topography[1]	Maximum Local Relief[2]	Permafrost
1. Galena AFS	Interior Western Alaska	Koyukuk Flats	Broad level plains; occasionally mantled by dunes; thaw lakes. Bottomland spruce, poplar forest.	143-105	40	Underlies entire area except recent flood plains.
2. Campion AFS	Interior Western Alaska	Koyukuk Flats	Broad level plains; occasionally mantled by dunes; thaw lakes. Bottomland spruce, poplar forest.	375-345	30	Underlies entire area except recent flood plains.
3. Cape Lisburne AFS	Arctic Foothills	---	Rolling plateaus, low linear mountains. Alpine tundra and barren ground.	1580-5	1575	Underlies entire area.
4. Fort Yukon AFS	Northern Plateaus	Yukon Flats	Lake-dotted marshy lowlands and gently sloping alluvial fans. Bottomland spruce and poplar forest.	406-405	30	Underlies most of area. Absent under rivers, meander belts and lakes.
5. Indian Mountain AFS	Interior Western Alaska	Indian River Upland	Low rolling mountains and linear ridges separated by narrow valleys. Upland spruce, hardwood forest.	4234-938	1500	Underlies entire area.
6. Kotzebue AFS	Coastal Western Alaska	Kobuk-Selawik Lowland	Broad river flood plains and low-lands forming deltas along seaward margins. Moist tundra.	145-10	30	Underlies most of area.
7. Murphy Dome AFS	Northern Plateaus	Yukon-Tanana Upland	Rounded, gently sloping ridges and domes. Upland spruce, hardwood forest.	2930-1490	400	Discontinuous.
8. Tin City AFS	Seward Peninsula	---	Broad convex hills, flat divides. Moist and Alpine tundra, some barren ground.	2289-10	2150	Underlies entire peninsula.

(1) Elevation in feet. May refer to NGVD or MSL (See Appendix I) datum planes.

(2) Relief is measured in feet and represents the change in elevation of ground surface in the immediate study area.

Source: Modified from Wahrhaftig (1965), Selkregg (1975, 1976b and 1976c), USGS 1:63,360 Scale topographic maps and installation documents.

FIGURE 3.3


AAC NORTHERN REGION
GALENA AFS DRAINAGE
INSTALLATION BOUNDARY
1403
1404
1405
2 DIKE PUMPS
2 DIKE PUMPS
2-18" DISCHARGE PIPES
FLOOD CONTROL DIKE
VILLAGE OF GALENA
YUKON RIVER
YUKON RIVER
LEGEND
DRAINAGE PATHWAY
STREAM
SCALE
0
1200
FEET
N
SOURCE: INSTALLATION DOCUMENTS

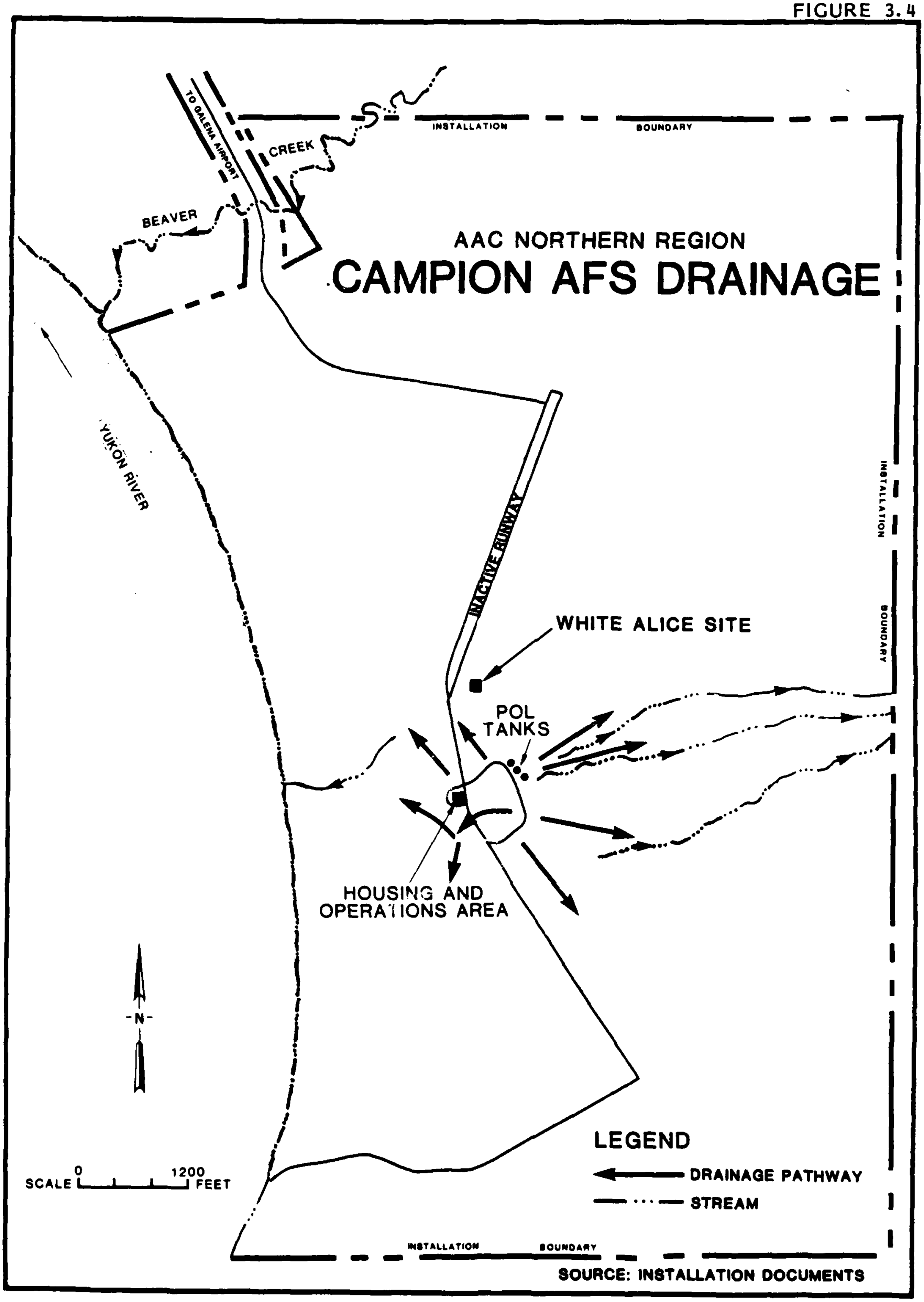
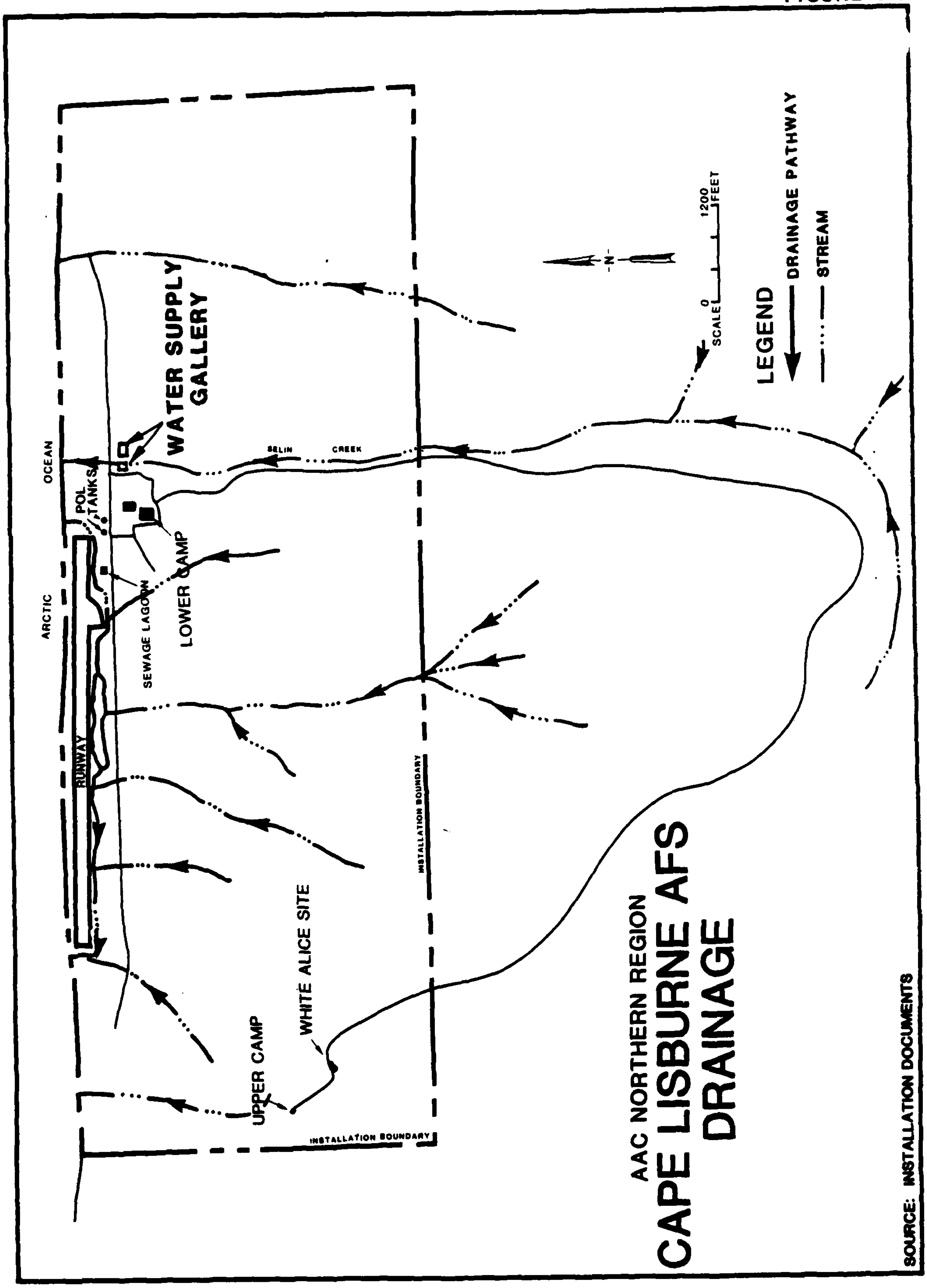

AAC NORTHERN REGION
CAMPION AFS DRAINAGE
TO GALENA AIRPORT
CREEK
BEAVER
INSTALLATION BOUNDARY
YUKON RIVER
INACTIVE RUNWAY
WHITE ALICE SITE
POL TANKS
HOUSING AND OPERATIONS AREA
N
SCALE 0 1200 FEET
LEGEND
DRAINAGE PATHWAY
STREAM
SOURCE: INSTALLATION DOCUMENTS

FIGURE 3.5



AAC NORTHERN REGION
CAPE LISBURNE AFS
DRAINAGE
SOURCE: INSTALLATION DOCUMENTS
LEGEND
DRAINAGE PATHWAY
STREAM
SCALE 0 1200 FEET
N
WATER SUPPLY GALLERY
SELIN CREEK
ARCTIC OCEAN
POL TANKS
LOWER CAMP
SEWAGE LAGOON
RUNWAY
INSTALLATION BOUNDARY
INSTALLATION BOUNDARY
WHITE ALICE SITE
UPPER CAMP

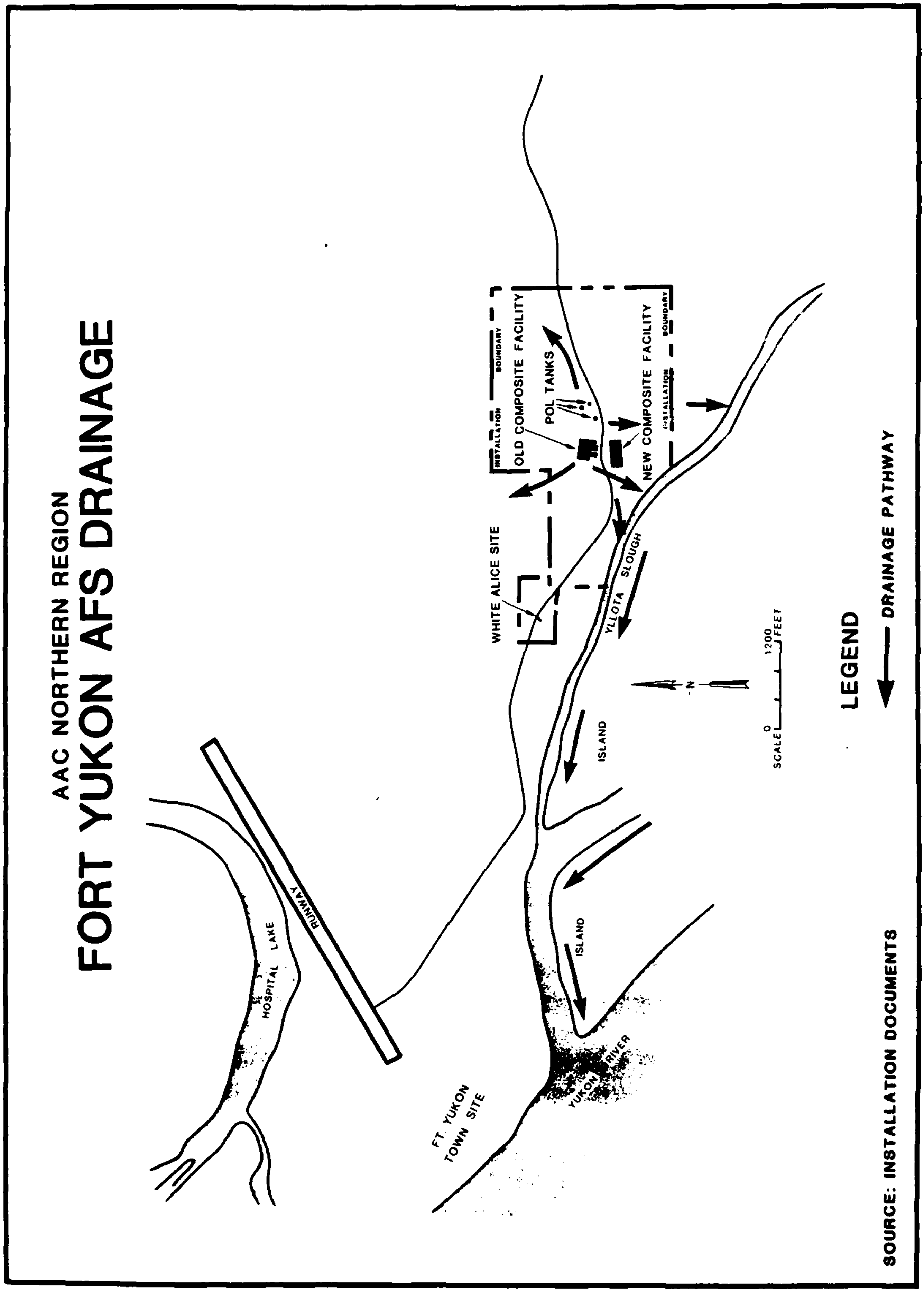
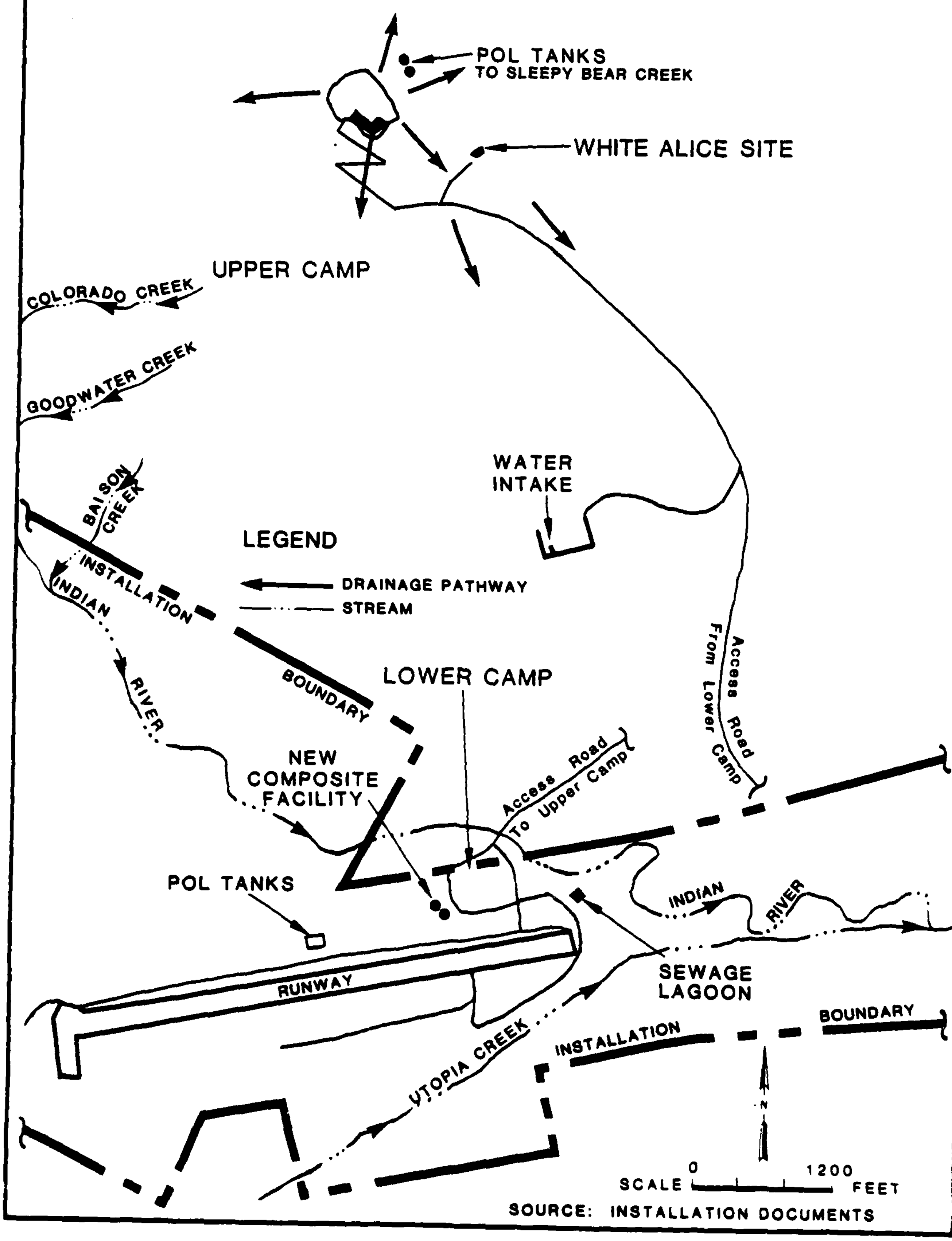

AAC NORTHERN REGION
FORT YUKON AFS DRAINAGE
INSTALLATION BOUNDARY
OLD COMPOSITE FACILITY
POL TANKS
NEW COMPOSITE FACILITY
INSTALLATION BOUNDARY
WHITE ALICE SITE
YLLOTA SLOUGH
ISLAND
ISLAND
YUKON RIVER
FT YUKON TOWN SITE
HOSPITAL LAKE
RUNWAY
N
SCALE 0 1200 FEET
LEGEND
DRAINAGE PATHWAY
SOURCE: INSTALLATION DOCUMENTS

FIGURE 3.7

AAC NORTHERN REGION
INDIAN MOUNTAIN AFS DRAINAGE



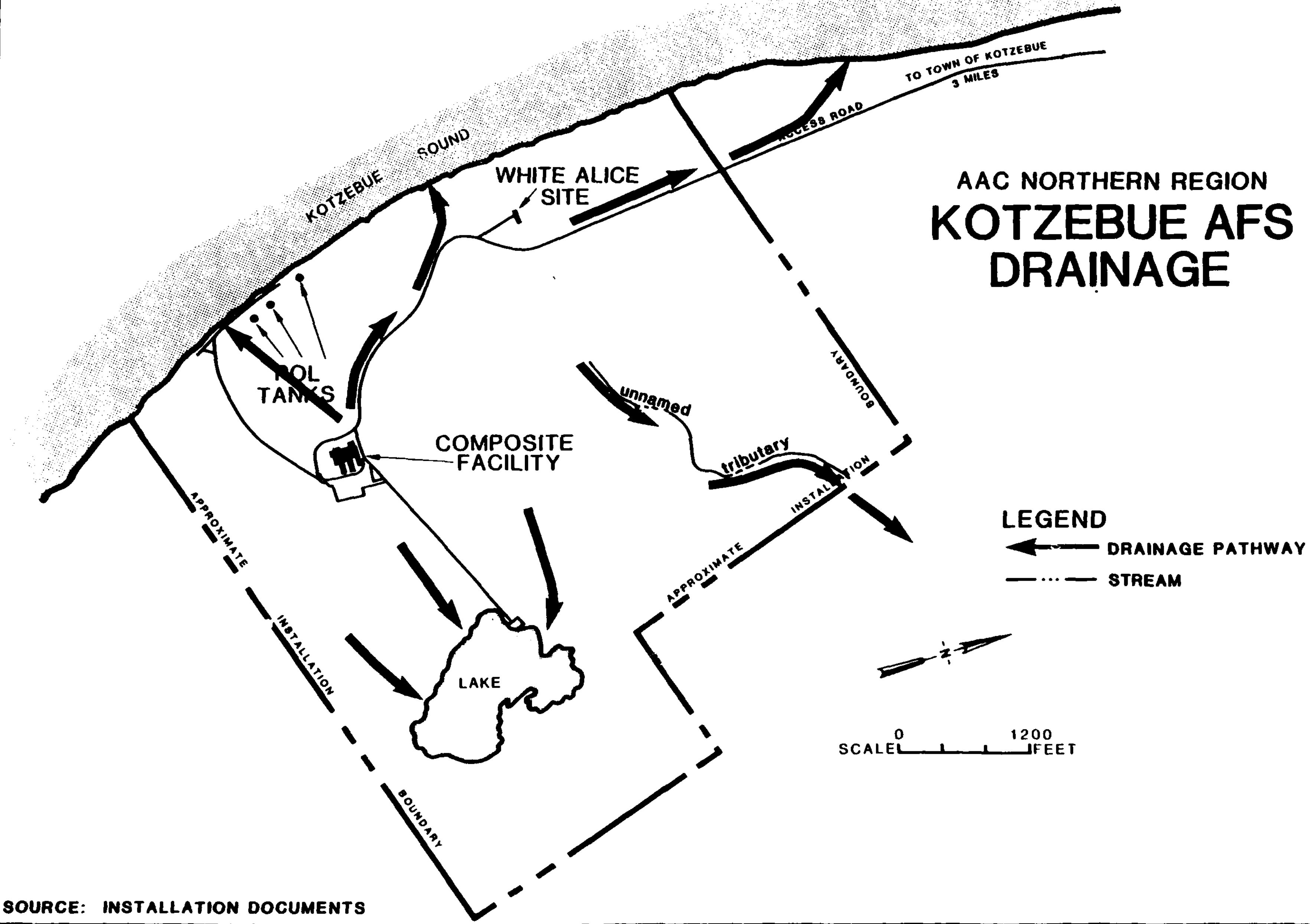
Due to its position within the floodway of the Yukon River, Galena AFS and the adjacent airfield have been enclosed within a flood protection dike, designed and constructed by the Alaska District, U.S. Army Corps of Engineers. The dike has been constructed to a maximum elevation of 143 feet, MSL. In 1972, flood waters associated with the annual spring break-up came within one-and-one-half feet of the dike's crest. Drainage within the diked area is controlled by swales, culverts and other diversion structures. Collected Galena AFS runoff is pumped over the dike to an unnamed Yukon River tributary by the two Air Force-owned pumps. Runoff collected from the airfield area is pumped over the dike to the Yukon River by two state-owned pumps located at the extreme southwest corner of the facility. Large wetlands are located immediately north of Galena AFS.

Runoff originating from Campion AFS is directed westward via overland flow to the Yukon River, or eastward to the several small lakes, streams and wetlands located east of the station. Because of the station's setting on a high terrace above the river, flooding is not known to be a problem.

The drainage of Cape Lisburne AFS land areas is accomplished by overland flow to diversion channels terminating at the Chukchi Sea. Some installation runoff is directed to Selin Creek, which also discharges to the Chukchi Sea. Selin Creek is significant because the base obtains its water resources from the shallow alluvial sediments underlying the stream. No wetlands exist at Cape Lisburne AFS. The U.S. Army Corps of Engineers has indicated some minor flooding has occurred next to the runway without any structural damage.

The drainage of Fort Yukon AFS is accomplished primarily by overland flow to the south to Yllota Slough, a Yukon River distributary, or northward into adjacent wetlands. Because Fort Yukon AFS is situated on a low terrace above the Yukon River, flooding is generally not a problem at the installation, however, the U.S. Army Corps of Engineers considers all of the Fort Yukon area to be a high hazard flood zone.

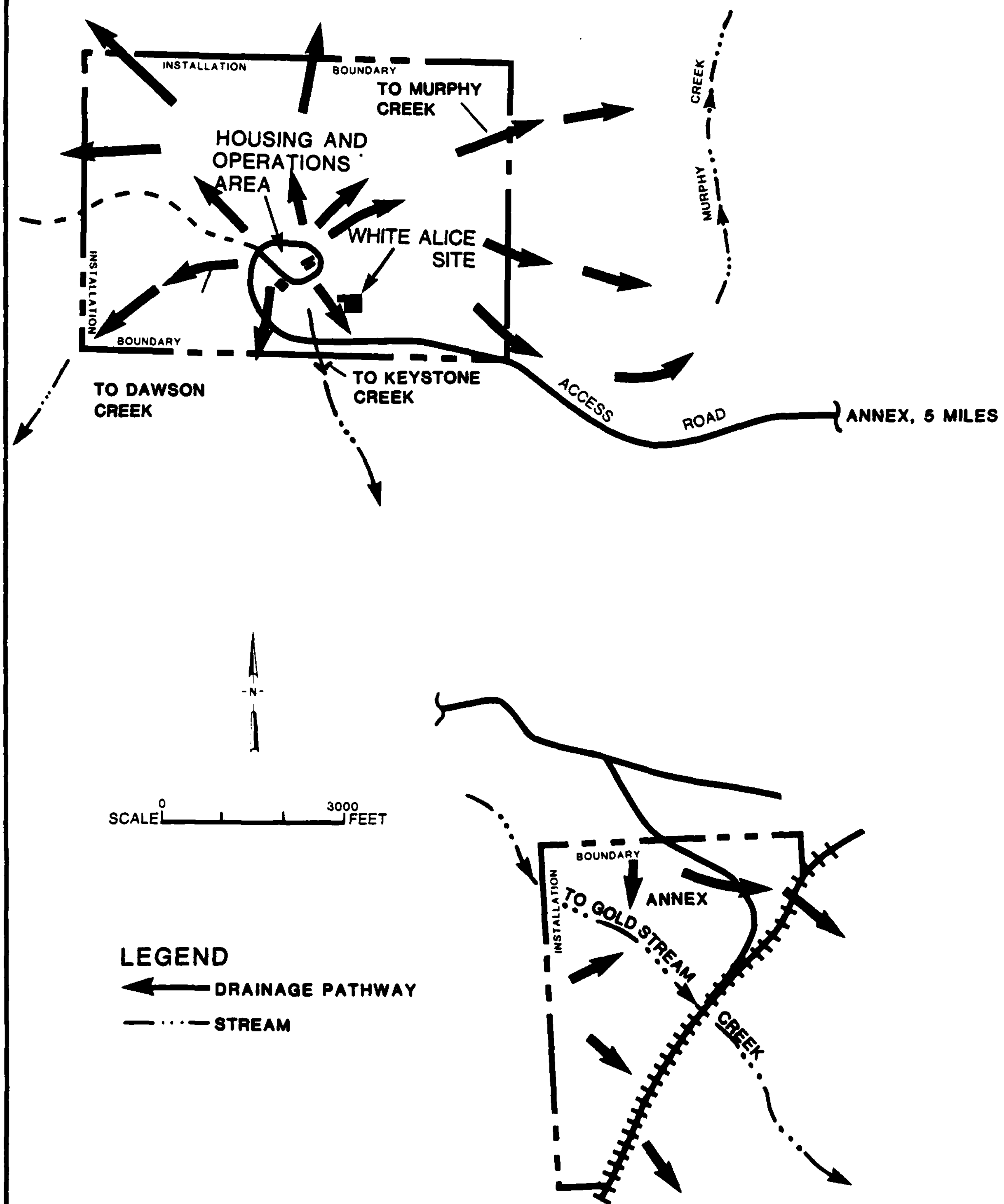
AAC NORTHERN REGION
KOTZEBUE AFS DRAINAGE



SOURCE: INSTALLATION DOCUMENTS

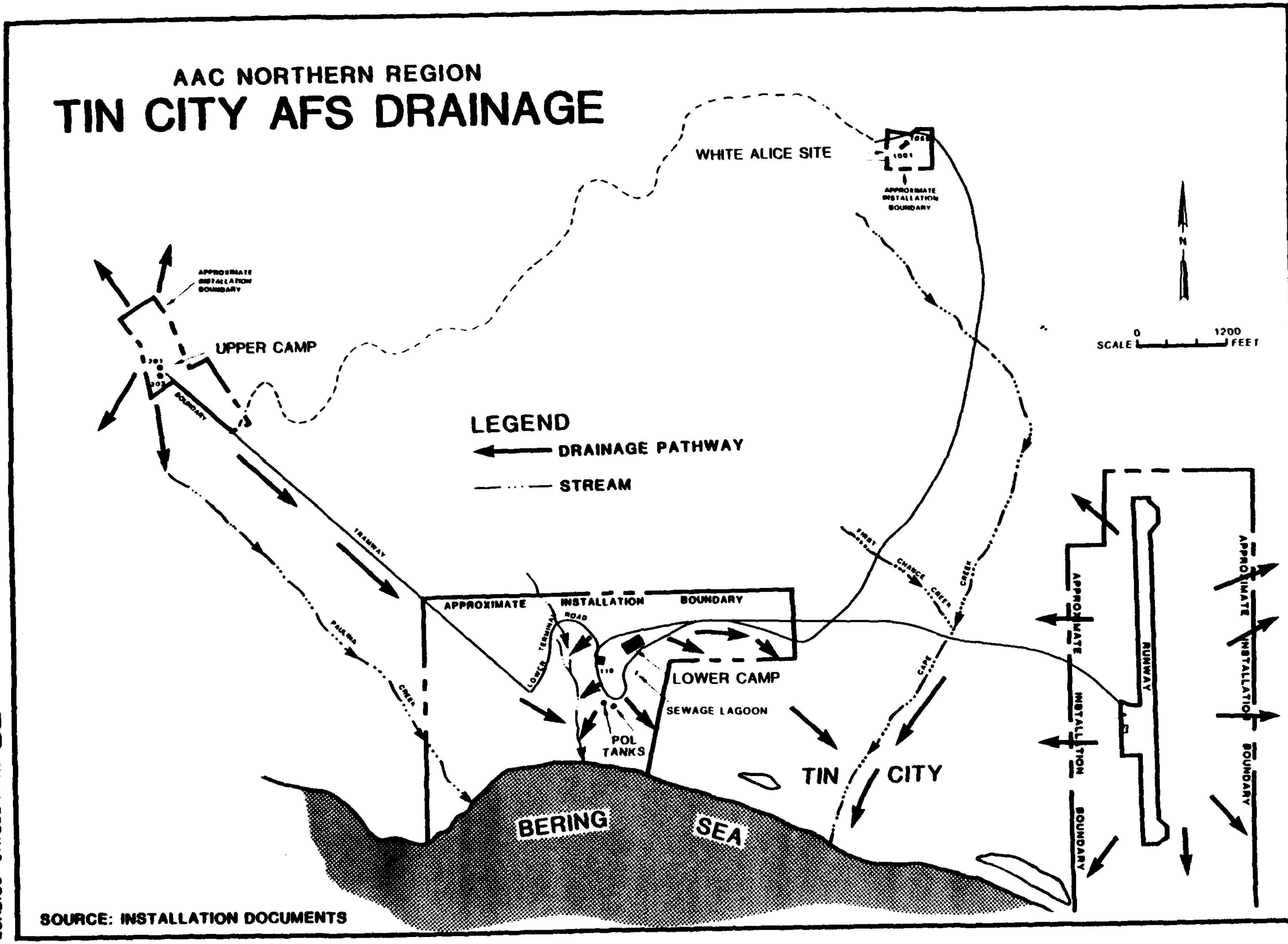
AAC NORTHERN REGION

MURPHY DOME AFS DRAINAGE



SOURCE: INSTALLATION DOCUMENTS

FIGURE 3.10


AAC NORTHERN REGION
TIN CITY AFS DRAINAGE
WHITE ALICE SITE
APPROXIMATE INSTALLATION BOUNDARY
UPPER CAMP
LEGEND
DRAINAGE PATHWAY
STREAM
SCALE
0
1200
FEET
N
TRAMWAY
BOUNDARY
APPROXIMATE INSTALLATION BOUNDARY
LOWER TERMINAL ROAD
LOWER CAMP
SEWAGE LAGOON
POL TANKS
FIRST CHANCE CREEK
CAPE CREEK
PAULINA CREEK
RUNWAY
TIN CITY
BERING SEA
SOURCE: INSTALLATION DOCUMENTS

The drainage of Indian Mountain AFS Upper Camp is accomplished by overland flow eastward to Sleepy Bear Creek and other unnamed tributaries of Notoniono Creek and southward to unnamed tributaries of the Indian River, which in turn flow to the Indian River. The Upper Camp collects runoff for its drinking water supplies. The drainage originating from the Indian Mountain AFS Lower Camp flows directly to the Indian River. Indian River is significant because the Lower Camp obtains its water supplies from the shallow alluvium underlying the river. Flooding is not a problem at Indian Mountain AFS. No wetlands exist in the study area.

The runoff originating from Kotzebue AFS is directed via overland flow to the west to Kotzebue Sound or east to the adjacent wetlands. Runoff draining east eventually reaches the base lake (installation water supply). Flooding is not known to have been a problem in the study area, although the U.S. Army Corps of Engineers indicates the site is in a coastal flood hazard zone (designated by the Federal Insurance Administration).

The drainage of Murphy Dome AFS is accomplished by overland flow north and east to unnamed tributaries of Murphy Creek and south to unnamed tributaries of Dawson and Keystone Creeks. An unnamed tributary of Goldstream Creek receives runoff from the installation annex located five miles southeast of Murphy Dome. Flooding is not known to be a problem in the study area. No wetlands are located on or near the installation.

The runoff originating from the Tin City AFS Upper Camp on Cape Mountain is directed via overland flow southeast to Paulina Creek or to an unnamed stream, both of which drain into the Bering Sea. The runoff developing at the Tin City AFS Lower Camp is directed via overland flow to an unnamed (on USGS topographic maps) stream which drains to the Bering Sea. The stream receiving Lower Camp drainage is identified as "Pauline Creek" on some installation documents. Tin City AFS does not experience any flooding problems. No wetlands have been mapped in the study area.

The local climate has a major impact on surface water drainage in the study areas. Childers, et al. (1979) reported that there is little or no stream flow during the winter on the western Arctic Slope. In-

stallation data suggests that streamflow is minimal during the winter period in the Yukon and interior regions, also.

Wetland areas have been identified on, or proximate to, Galena AFS, Campion AFS, Fort Yukon AFS and Kotzebue AFS.

Surface Soils

Soils information is obtained in order to provide generalized descriptions of the basic soil types that may be present at a given facility and to furnish the data essential for the completion of the Hazard Assessment Rating Methodology (HARM) forms. Data for this subsection was obtained from Furbush (1971) and from U.S. Department of Agriculture, Soil Conservation Service (USDA, SCS) (1963 and 1979). Much of the information is of a reconnaissance-level effort and is not intended to be site-specific. The essential data elements have been summarized in Table 3.3 for the eight USAF facilities included in this study.

REGIONAL GEOLOGY

Information describing the geology of the AAC Northern installation study areas has been reported by the following sources: Cobb (1974); Coulter, et al. (1965); Ferrians (1965); Karlstrom, et al. (1964); Péwé (1975); Péwé, et al. (1967); Reger (1979) and Selkregg (1975, 1976a, 1976b, 1976c). Additional information has been obtained from miscellaneous installation documents (such as test boring and water well logs) and from interviews with U.S. Geological Survey personnel. A brief overview of the geologic information relevant to this study follows.

Geologic units of all the principal time-stratigraphic systems from Pre-Cambrian to Quaternary are represented in Alaska. The major interior mountain chains have cores of Pre-Cambrian rocks; the core of the Coast Range is generally Mesozoic, bordered by younger sedimentary and volcanic materials. The lower mountains and hills are formed of like materials or of Mesozoic sedimentary rocks (Feulner, et al., 1971). The coastal plains are formed by sedimentary materials of Mesozoic to Cenozoic age. Intense structural deformation has continued throughout Alaska's geologic history and has periodically modified the major geologic units by faulting, warping and folding. The deformational activity is pronounced along the state's Pacific Coast. Active volcanoes

TABLE 3.3
SUMMARY OF INSTALLATION SOILS

Installation	USDA, SCS Report Map Symbol	Unit Name	Description	Occurrence	Remarks
1. Galena AFS	IQ3	Histic pergelic cryaquepts-typic cryofluents.	Organic silt, peat, silt, sand gravel, loam (stratified).	Flood plains.	Poorly drained soils with a peaty surface layer; shallow permafrost. Moderate erosion potential.
2. Campion AFS	IQ3	Histic pergelic cryaquepts-typic cryofluents.	Organic silt, peat, silt, sand gravel, loam (stratified).	Flood plains.	Poorly drained soils wih a peaty surface layer; shallow.permafrost. Moderate erosion potential.
3. Cape Lisburne AFS	RM2	Rough mountainous land-lithic cryorthents.	Bedrock outcrops; thin sand, gravel or boulder layers.	Deeply dissected foothills.	High permeable. Permafrost is present at lower elevations where soil cover is thickest.
4. Fort Yukon AFS	EF2	Typic cryofluents-histic pergelic cryaquepts.	Silt, loam, peat, fine sand.	Flood plains; low terraces.	Poorly drained, low to moderate permeability. Permafrost is usually present. Low erosion potential.
5. Indian Mountain AFS	RM2	Rough mountainous land-lithic cryorthents.	Bedrock outcrops, thin sand, gravel or boulder layers.	Deeply dissected foothills.	Highly permeable. Permafrost is present at lower elevations where soil cover is thickest.
6. Kotzebue AFS	IQ2	Histic pergelic cryaquepts.	Silt, fine sand, loam, peat.	Alluvial plains.	Moderately permeable. Permafrost is present at shallow depths.
7. Murphy Dome AFS	IR12	Histic pergelic cryaquepts-typic cryorthods.	Silt, loam, gravel, peat.	Rolling hills, colluvial slopes.	Well to poorly drained. Low to moderate permeability. Permafrost may be present.
8. Tin City AFS	IQ7	Histic pergelic cryaquepts-nearly level to rolling pergelic cryaquepts.	Silt, gravel, sand, loam.	Steep ridges, knolls.	Poorly drained. Moderate permeability. Permafrost occurs at shallow depths.

Source: Modified from USDA, *Soil Conservation Service*, 1979.

are located in the Wrangell Mountains of interior Alaska, the Alaska Peninsula and in the Aleutian Islands. The predominant structural trend parallels the Pacific Coast.

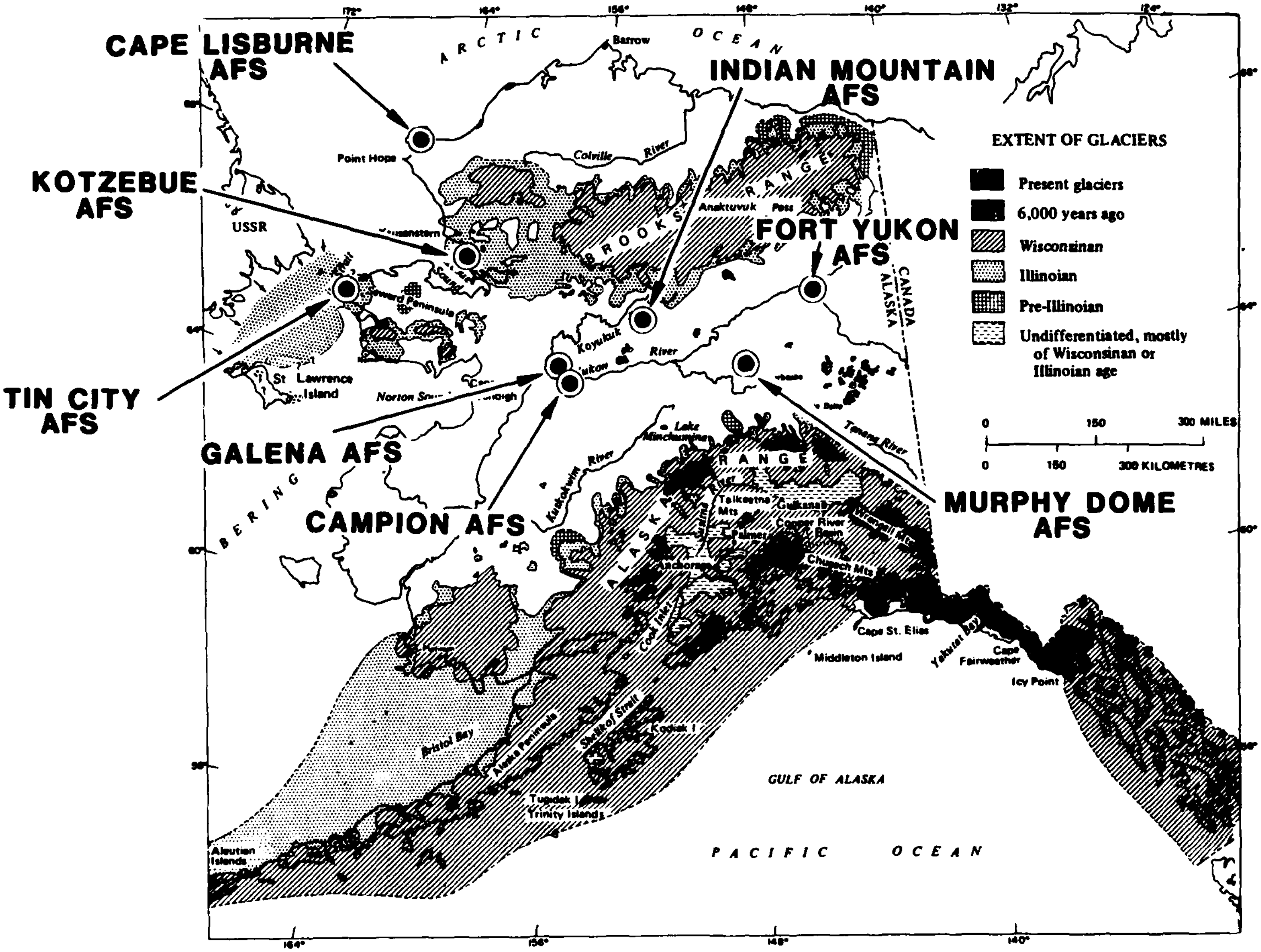
For the last two to three million years, frost climates have prevailed in Alaska and the geomorphic processes have been either glacial or periglacial (Wahrhaftig, 1965). During Quaternary time, Alaska's landscapes have been reworked by the advance and retreat of the extensive continental glaciers. Changing firn lines delineate the glacial movement. Remnants of the glaciers are present today in the higher elevations of the Coast and Alaska Ranges. Although glacial activity was extensive, it was by no means all-encompassing. Glaciation is evident in many parts of the state including the Pacific Mountain System, the Arctic Mountains, the Ahklun Mountains and southern Seward Peninsula. However, some great expanses received no glacial activity. The principal areas not glaciated include the Intermontaine Plateaus, the Arctic Foothills and the Arctic Coastal Plain. Figure 3.11 depicts the extent of Alaska's glaciated areas. The glacial activity is significant in that its advance eroded the uplands into blocklike groups of mountains with rounded crests separated by U-shaped valleys and low passes. The ridges and peaks that rose above the upper ice sheet elevations remained angular and sharp in appearance (from Wahrhaftig, 1965). The mountain ranges crowned by such peaks exhibit dramatic relief and their valleys head in near vertical glacier-covered cirques. Glaciated lowlands tend to be inconsistent and include such features as moraines, drumlins, kames, eskers and glacial lake plains. Rock basin and glacial-deposit dammed lakes of great size and depth are common features of the glaciated lowland margins. The retreat and melting of the large glaciers produced great quantities of outwash sediment which has resulted in the filling of many basins and lowlands. Each spring, large quantities of sediment continue to clog many of Alaska's major rivers and streams. The sediments are transported downstream with the flow to be deposited eventually many miles from their points of origin.

One of the most widely distributed Quaternary sediments is loess, a wind-blown silt. Loess deposits occur in most areas of Alaska below elevations of 1,500 feet, ranging in thickness from a few fractions of

FIGURE 3.11

AAC NORTHERN REGION

QUATERNARY GLACIATION IN ALASKA



SOURCE: MODIFIED FROM Péwé, 1975

an inch to two hundred feet. The thickest loess deposits occur in central and western Alaska (Péwé, 1975).

Alaska's generally cold climatic regime has produced a condition termed "permafrost," a combination of geologic, hydrologic and meteorologic characteristics which produce permanently frozen ground. Permafrost occurs in both unconsolidated sediments and bedrock and its distribution includes most of the state with the notable exception of the Pacific Coastal area. The occurrence of permafrost varies from thin, scattered zones in the central Alaskan lowlands to sections more than 2,132 feet thick near Prudhoe Bay (Selkregg, 1975). Permafrost has a significant impact on the flow of ground water, which is described in greater detail later in this section. The distribution of Alaska's permafrost areas is shown in Figure 3.12. Permafrost is mapped in Alaska as continuous, discontinuous or absent. The different permafrost forms may be signified by the types of pingoes (ice-cored, conical hills) present. Pingoes are described in greater detail later in this section of the report.

The very strong geologic processes at work today in Alaska have produced a unique environmental setting reflected in the Quaternary Geologic Map of the state (Figure 3.13). For example, Qg (Quaternary glacial deposits) represents the extent of materials common to Alaska's glaciated alpine mountains and Qa (Quaternary alluvium), illustrates the distribution of flood plain alluvium in the major stream valleys.

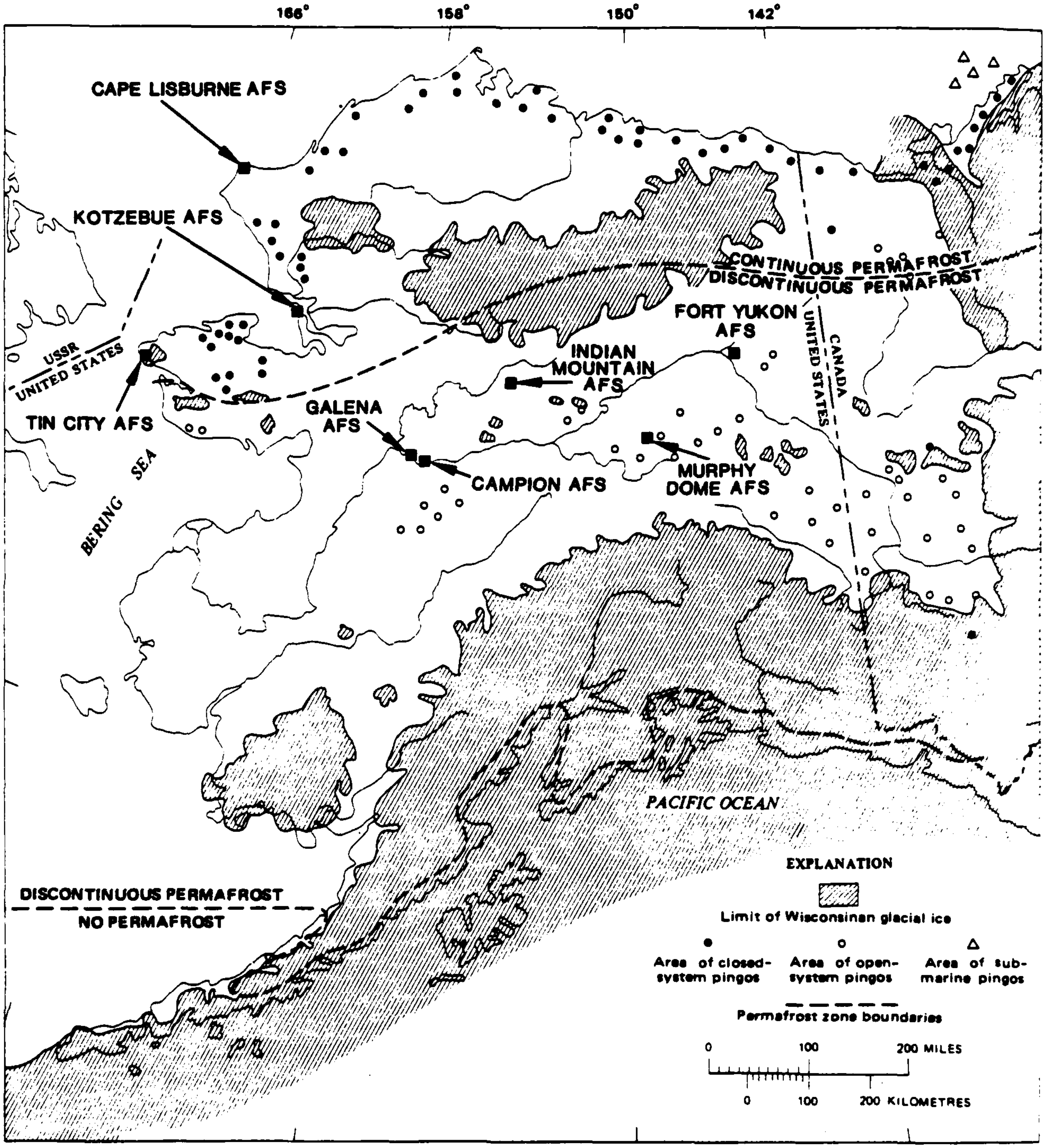
SITE-SPECIFIC GEOLOGIC SUMMARIES

Galena AFS and Campion AFS

Galena AFS and its companion installation, Campion AFS are described together because of their relative proximity and location within the same general area. Galena AFS is located within the floodway of the Yukon River. Campion AFS is situated on a high river terrace, well above the modern flood plain. The two installations are situated within the Yukon-Koyukuk Basin, an extensive structural trough which extends from the Bering Sea to a point a few miles west of the Canadian border. The Yukon River system has developed in this area, depositing large quantities of sediments as it matures. The entire Yukon region is characterized by meandering streams. Erosion proceeds along the outer

AAC NORTHERN REGION

PERMAFROST ZONES OF ALASKA

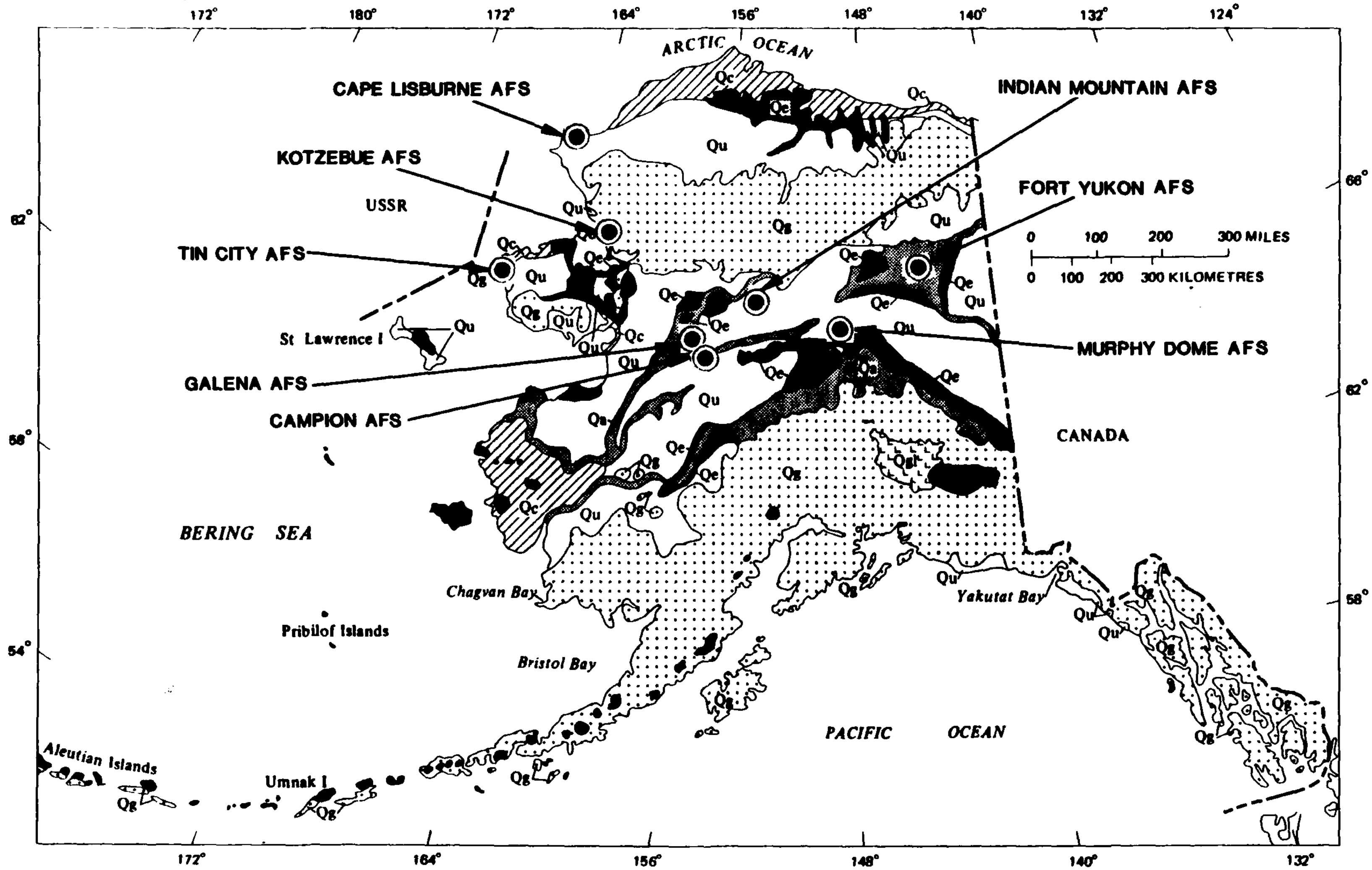


SOURCE: MODIFIED FROM Péwé, 1975

FIGURE 3.13

AAC NORTHERN REGION

QUATERNARY GEOLOGIC MAP OF ALASKA



Sketch map of major regional groups of surficial deposits in Alaska. Qg, glacial and other deposits associated with heavily glaciated alpine mountains; Qgl, glaciolacustrine deposits of larger Pleistocene proglacial lakes; Qu, undifferentiated deposits associated with generally unglaciated uplands and lowlands of the Interior and North Slope; Qa, fluvial deposits; Qe, eolian deposits; Qc, coastal deposits of interbedded marine and terrestial sediments. Solid black areas are deposits associated with volcanic peaks and flows.

SOURCE: MODIFIED FROM Péwé, 1975

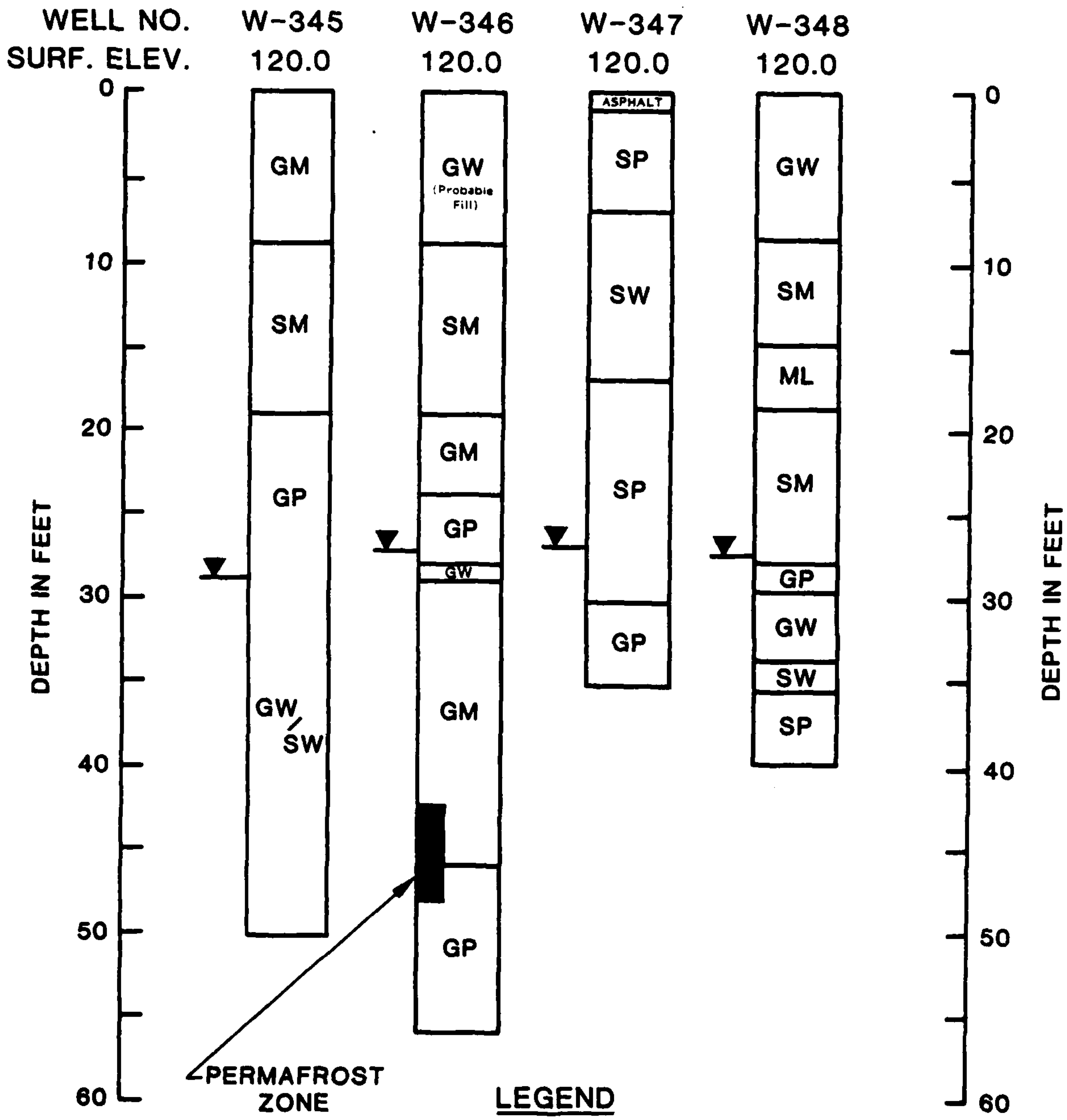
stretches of meander bends where flow is rapid and deposition takes place along the insides, where stream flow occurs more slowly. Chutes develop when irregular deposition creates ridges and troughs as the meander moves further from the primary stream alignment. A chute may be seen as an attempt by the river to return to a shorter course. Oxbow lakes form as a result of the chute cutting off a former meander, isolating it by the deposition of large quantities of sediment which infill parts of the old channel. This process continues at present and prompted the construction of a sheet piling wall opposite the Galena airfield to provide erosion protection.

The geology of the Galena-Campion area is dominated by the Quaternary sediments deposited by the Yukon River. These alluvial materials are unconsolidated stratified layers of silt and sand near the top of the sequence, underlain by considerable thicknesses of gravel, sandy gravel, silty sand and sand. The total accumulation of sediments in the Galena-Campion study area is at least 202.5 feet, according to the driller's log for Galena AFS Well No. 4 (USGS-WRD file data, undated). The logs of numerous construction test borings and test wells were examined for this study. They indicate that much of the Galena AFS surface area has been filled, using silty gravel or poorly graded gravel, presumably to stabilize soft alluvial and organic soils to permit base development. The fill d area extends over much of the station land area. The fill ranges in thickness from four to nine feet and was placed directly on the underlying sediments. Some heavy structures, such as the power plant were built on pile foundations because of the relative compressibility of the alluvial soils. Most of the approximately 350 test borings, test pits and wells advanced at Galena AFS encountered permafrost, occurring either as isolated lenses within ten feet of land surface or as substantial thicknesses 20 or more feet below grade. The distribution of permafrost beneath the station is sporadic adjacent to the Yukon River; its most pronounced occurrence appears to be beneath the east half of the airfield area and the station industrial area, where it is reported to be 110 feet thick (Selkregg, 1976c). Figure 3.14 is the log of a test well drilled at Galena AFS. The well log illustrates the typical near-surface geologic conditions encountered by subsurface exploration at the station.

FIGURE 3.14

AAC NORTHERN REGION

GALENA AFS USGS TEST WELL LOGS



LEGEND

UNIFIED SOIL CLASSIFICATION SYSTEM
(U.S. ARMY TM 3-357)

GW	WELL GRADED GRAVEL
GM	SILTY GRAVEL
GP	POORLY GRADED GRAVEL
SM	SILTY SAND
SP	POORLY GRADED SAND
SW	WELL GRADED SAND
ML	LOW PLASTICITY SILT

LOCATION: SEE FIGURE 3.21

SOURCE: INSTALLATION DOCUMENTS

Campion AFS Well No. 2 encountered alluvial sediments to its maximum depth of 420 feet below grade. The sediments consisted of silt, sand and gravel in discrete zones. Permafrost was noted on the driller's log, from near ground surface to a depth of 377 feet, 2 inches below grade. Presumably, the permafrost is continuous within this range (from USGS-WRD file data, undated).

Cape Lisburne AFS

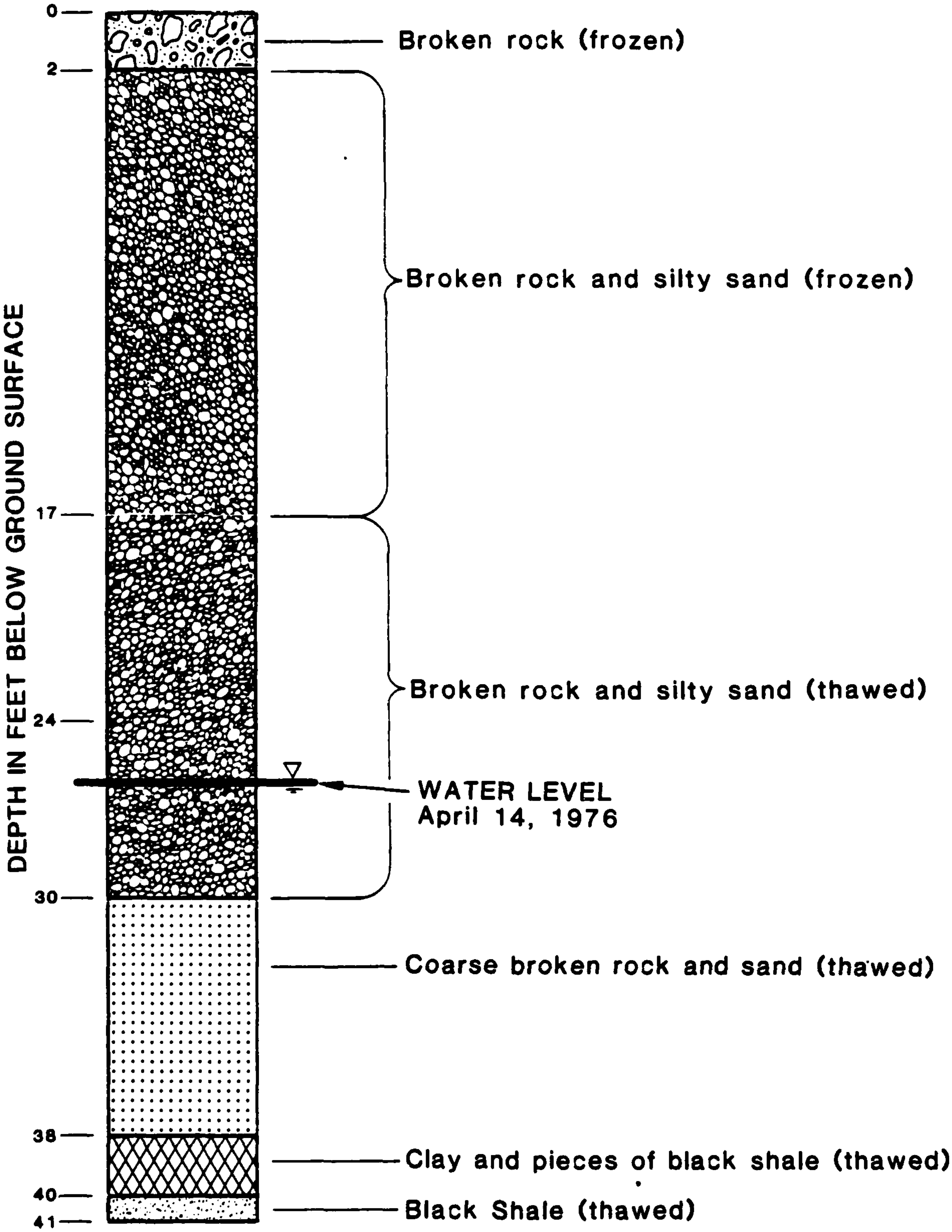
The geology of the Cape Lisburne AFS Lower Camp and airfield is dominated by talus (rock fragments and finer materials accumulating at the bases of steep slopes) and alluvial fan deposits, consisting of clay, silt, sand, gravel and cobbles with some boulders present. A tundra surface layer mantles the coastal lowland. The materials may be mixed where they occur as talus (deposited as a result of downslope unchannelized runoff) but appear to be stratified along the course of Selin Creek (Feulner and Williams, 1967). The stream alluvium is on the order of forty feet thick near the station water intake (USGS-WRD file data, undated). The unconsolidated deposits are underlain by black shale. Figure 3.15, the log of a test well drilled near the installation water supply intake, illustrates local subsurface conditions. The geology at the Cape Lisburne Upper Camp is dominated by relatively thin accumulations of gravelly, bouldery residuum. Shale bedrock crops out along steep-walled slopes and in eroded areas. The occurrence of permafrost is relatively continuous in the Cape Lisburne study area and may reach maximum depths of 600 to 800 feet below grade in zones near large bodies of water. Further inland, maximum permafrost depths may reach 1330 feet below grade (Ferrians, 1965).

Fort Yukon AFS

Fort Yukon AFS is located in the Yukon Flats area, part of the large Yukon-Koyukuk Basin. The geology is dominated by the Yukon River alluvial sediments, as above. The sediments are generally well-sorted flood plain and terrace materials consisting of silt, sand and gravel. An organic soil surface layer may be present. Péwé (1975) reported that some 100 feet of lacustrine deposits (lake sedients, predominantly silt and clay) in the Fort Yukon area. Figure 3.16 is the log of a representative test boring advanced in the study area. The log illustrates the typical shallow geologic conditions encountered at Fort Yukon AFS.

AAC NORTHERN REGION

CAPE LISBURNE AFS WELL LOG



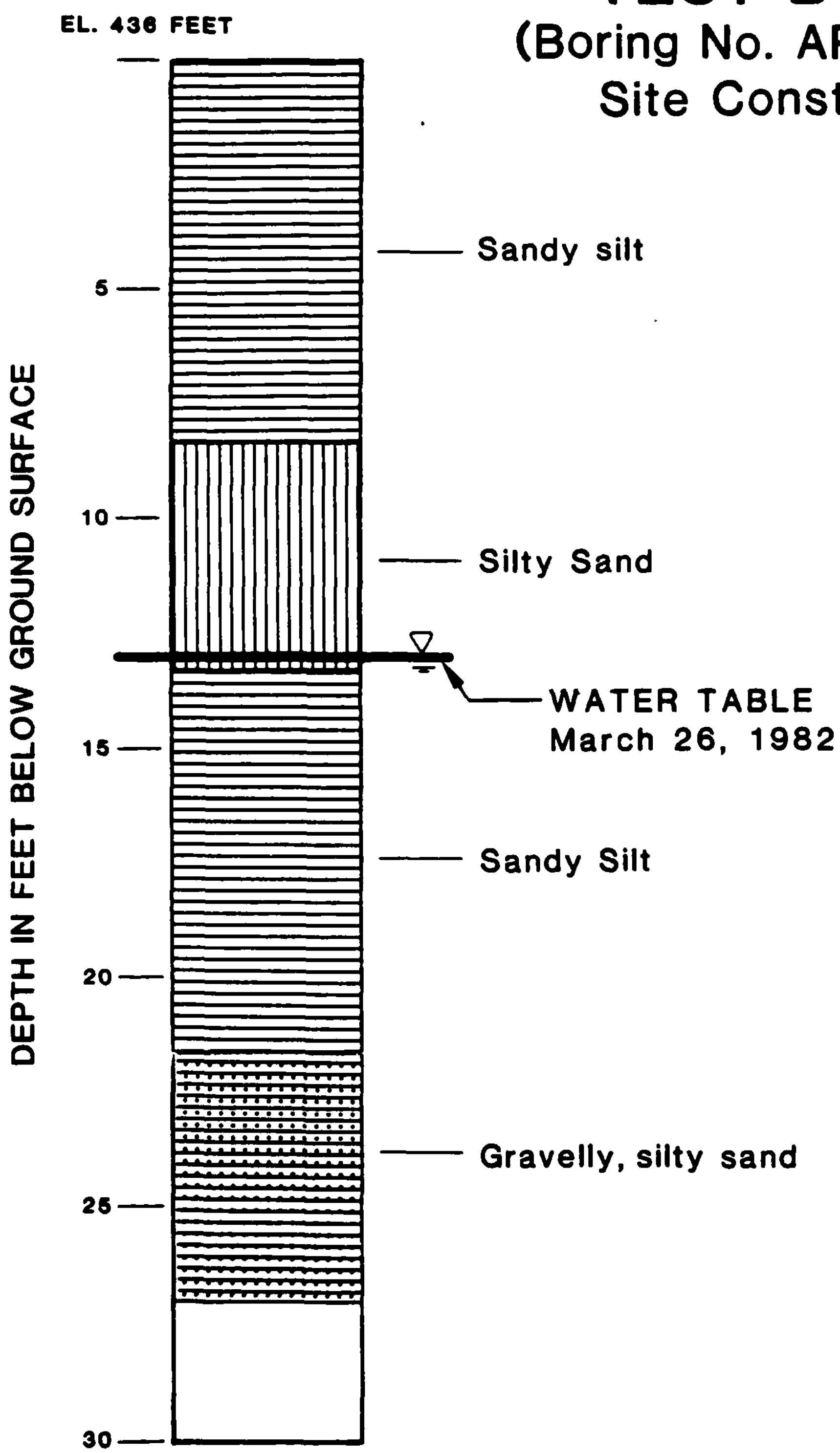
SOURCE: MODIFIED FROM US GEOLOGICAL SURVEY WATER RESOURCES DIVISION FILE DATA, UNDATED.

FIGURE 3.16

AAC NORTHERN REGION

LOG OF FORT YUKON AFS TEST BORING

(Boring No. AP-107-MAR Site Construction)



LOCATION: 100 FEET SOUTH OF EXISTING COMPOSITE BUILDING

SOURCE: MODIFIED FROM INSTALLATION DOCUMENTS

Ferrians (1965) indicates that discontinuous permafrost is present in the study area. The maximum depth to the base of permafrost ranges from 18 to 390 feet below grade in the Fort Yukon area.

Indian Mountain AFS

The geology of the Indian Mountain bottom camp is dominated by recent alluvium deposited by the Indian River and its local tributaries. The alluvium consists of stratified accumulations of silt, sand and gravel. The maximum thickness of the alluvial deposits is unknown; they are at least greater than 25 feet (the depth to which the water supply gallery was constructed across the course of the Indian River). The Upper Camp geology consists of thin deposits of residual sand, gravel and cobbles overlying andesitic bedrock. Reger (1979) reported that the north and northeast slopes of Indian Mountain were glaciated. Thin accumulations of outwash sand and gravel were mapped along isolated steep slopes, valley heads and parallel to the alluvial fans of Sleepy Bear and Cirque Creeks. The bedrock crops out along steep slopes and on eroded mountain surfaces. Altiplanation terraces are common on Indian Mountain. Permafrost is reported to range from moderately thick to relatively thin within the Indian Mountain AFS study area. It may be absent locally, especially near large water bodies. Permafrost development is usually most pronounced in fine-grained sediments and is less well-developed in coarse-grained materials or in bedrock.

Kotzebue AFS

Kotzebue AFS is located on a recurved spit, separated from the north end of the Baldwin Peninsula by a brackish water lagoon (Williams, 1970). The lagoon freezes solid each winter. The installation is situated on the remnants of an eroded moraine.

The geology of the Kotzebue AFS study area is dominated by glacial moraine and drift deposits which are overlain locally by thin sandy beach deposits. These deposits include mixed clay, silt, sand and gravel. Their maximum thickness is uncertain. Permafrost is moderately thick in the study area and has been reported to be present to a depth of 238 feet below grade in the Kotzebue area. The permafrost is underlain by fine-grained sediments containing brackish water; increasing salinity has been reported with depth (Williams, 1970).

Murphy Dome AFS

The geology of Murphy Dome AFS is dominated by thin residual clay, silt, sand, gravel and cobble deposits overlying metamorphic bedrock. Alluvial sand and gravel deposits have accumulated in lowland areas at the base of the dome and in local stream valleys, such as that of Murphy Creek. The thickness of the alluvium is highly variable. The underlying schist bedrock crops out along steep slopes and on eroded mountain surfaces. Permafrost is reported to be discontinuous in the study area. Locally, it may be completely absent.

Tin City AFS

The geology of the Tin City AFS study area is dominated by undifferentiated alluvium and slope deposits (talus) common to steeply sloping and mountainous regions. The surficial geology of the lower elevations such as at the base camp consists of thin accumulations of mixed silt, sand, gravel, cobbles and boulders overlying bedrock. Top camp geology may consist of a thin veneer of residual (weathered rock) soils. Granitic bedrock outcrops are common on the steep slopes and on eroded mountain top areas. Figure 3.17, the log of Tin City AFS Well No. 4, indicates that the unconsolidated deposits are only 9.5 feet thick at the well site at the Lower Camp. Weathered, fractured granitic bedrock underlies the sediment. Permafrost is reported to be generally confined to fine-grained sediments in the study area. The log of Well No. 4 does not indicate that permafrost was encountered during the drilling of the well. It is not known if this is an indication of the absence of permafrost in the immediate study area.

GROUND-WATER RESOURCES

Information describing study area ground-water resources has been reported by Anderson (1970); Cederstrom (1963); Feulner (1964 and 1966): Feulner, et al. (1971); Feulner and Williams (1967); Nelson (1978); Williams (1970) and Zenone and Anderson (1978). Additional information has been obtained from U.S. Geological Survey Water Resources Division file data (undated) and from interviews with USGS personnel.

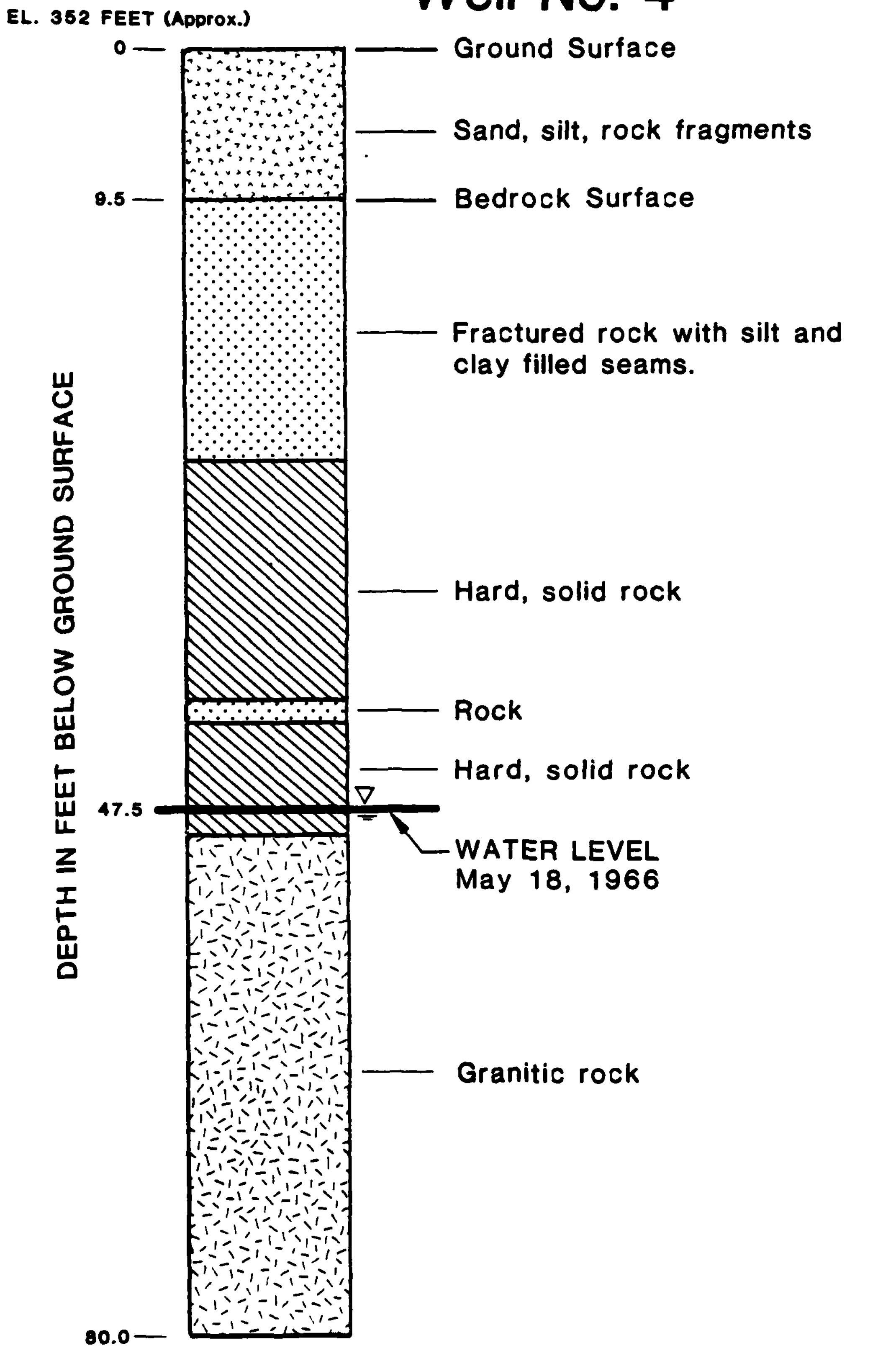
Ground Water in Alaska

Alaska's ground-water resources are reported to be highly variable. The most productive ground-water sources are the unconsolidated alluvial

FIGURE 3.17

AAC NORTHERN REGION

TIN CITY AFS WELL LOG
Well No. 4



SOURCE: MODIFIED FROM US GEOLOGICAL SURVEY WATER RESOURCES DIVISION FILE DATA, UNDATED.

aquifers of the state's major river valleys and the glacial outwash aquifers underlying coastal basins and some lowland areas. No major aquifers have been identified in glacial and glaciolacustrine formations of the interior valleys or in deltaic deposits (Zenone and Anderson, 1978). Major bedrock aquifers are restricted to the carbonate rocks of the Brooks Range of Arctic Alaska and along the north side of the Alaska Range. Most bedrock aquifers in Alaska exhibit poor hydraulic qualities and produce only small yields locally.

In order to facilitate the study of Alaska's ground-water resources, four generalized geohydrologic environments have been described by Williams (1970). They include:

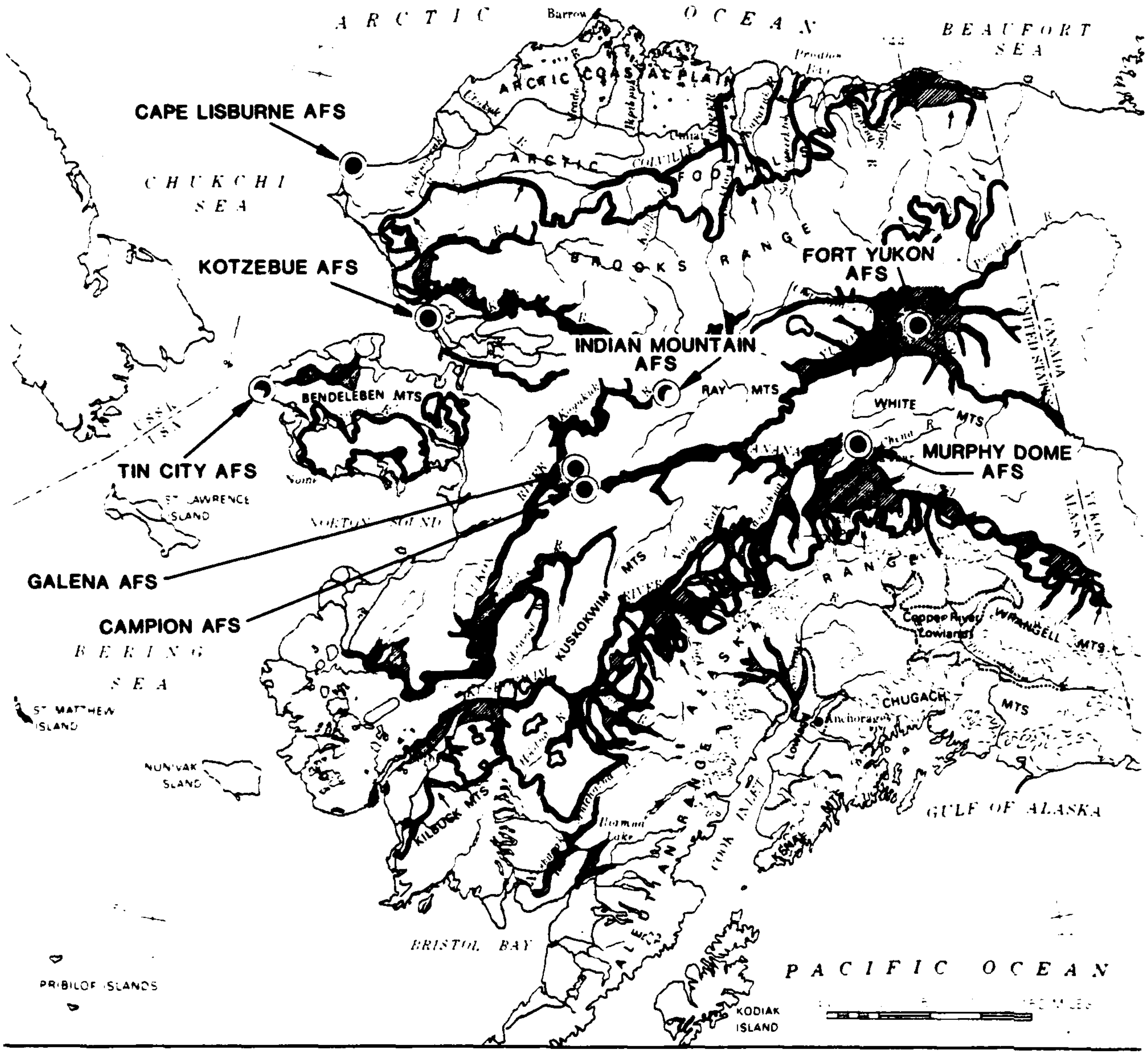
1. Alluvium of flood plains, terraces and fans in major valleys and in upland and mountain areas. These materials tend to be prolific aquifers.
2. Coastal lowland deposits.
3. Glacial and glaciolacustrine deposits of the interior valleys. These materials tend to be poor water producers.
4. Bedrock aquifers of the uplands and mountain ranges. These are prolific locally, but usually tend to be poor water producers.

The distribution of the four major geohydrologic units occurring in Alaska is shown in Figure 3.18. It is noted that this figure is an attempt to clarify the discussion of Alaska's ground-water resources; local variations likely occur.

No discussion of Alaska's ground-water resources is complete without due consideration given to the subject of permafrost. Permafrost is defined by the <u>Glossary of Geology</u>, (American Geological Institute, 1972, Washington, D.C.) as "any soil, subsoil, or other surficial deposit, or even bedrock, occurring in arctic or subarctic regions at a variable depth beneath the Earth's surface in which a temperature below freezing has existed continuously for a long time (from two years to thousands of years). This definition is based exclusively on temperature and disregards the texture, degree of compaction, water content and lithologic character of the material." Permafrost is variable in

FIGURE 3.18

AAC NORTHERN REGION
GEOHYDROLOGIC UNITS OF ALASKA



EXPLANATION

Alluvium of major valleys
Sand, gravel, and silt of flood plains, low terraces, and alluvial fans

Coastal-lowland deposits
Chiefly silt and sand, and subordinate amounts of gravel, includes sand and gravel of bars, beaches and spits and sand, silt and gravel of deltas. Within limits of Pleistocene glaciation, include till, glaciomarine, and glaciestuarine deposits

Bedrock of mountains and uplands
Chiefly bedrock mantled locally by weathered bedrock rubble reworked by frost action, alluvium, and eolian deposits, and, within limit of Pleistocene glaciation, by glacial deposits

Limit of Pleistocene glaciation
Unconsolidated deposits within this limit may include till, sand and gravel, and silt and clay of glacial, glaciolacustrine, glaciomarine, or glaciestuarine origin

Cook Inlet and Copper River Lowlands
Approximate upper limit of lacustrine silt, clay sand, gravel and stony silt and clay of extensive glacial lakes in Copper River Lowland and of glaciolacustrine, glaciestuarine, and glaciomarine deposits in the Cook Inlet lowland

Major glaciers and ice fields

Contact

SOURCE: MODIFIED FROM WILLIAMS, 1970

thickness and is reported to underlie twenty percent of the world's land area.

Permafrost has a major impact on the relationship of surface water and ground water in cold regions such as Alaska. The distribution of the principal permafrost regions in Alaska is shown in Figure 3.12. Although ground water in permafrost regions occurs according to the same geologic and hydrologic principles present in temperate areas, the hydrologic regime is modified in the following ways:

- Permafrost acts as an impermeable barrier to the movement of ground water because pore spaces are ice-filled in the zone of saturation. Recharge and discharge are, therefore, limited to the unfrozen channels penetrating the permafrost zone. The unfrozen channels are termed perforating taliks. Permafrost restricts the downward percolation of water and increases runoff, enhancing the creation of lakes and swamps (Feulner, et al., 1971).
- Permafrost ranges in thickness from a few inches to more than 2,000 feet. Therefore, it restricts an aquifer's storage capacity and the number of locations from which ground water may be withdrawn. It is commonly necessary to drill to greater depths than in similar geologic settings occurring in warm climates. Suprapermafrost ground water occurs in the active zone above the permafrost table and tends to be seasonal; it freezes solid during the cold winter months. Subpermafrost ground water is usually dependable, because it occurs beneath the permafrost zone.
- The ground-water temperature varies from 0° to 4.5°C in permafrost regions because of the low ground temperatures. Water tends to be more viscous in this temperature range and, therefore, moves more slowly than in temperate regions.
- Permafrost zones tend to reduce evapotranspiration. The generally low ground temperatures tend to reduce direct evaporation and also transpiration by retarding the growth of vegetation locally. Vegetation growth is enhanced near large surface water bodies where permafrost is absent.

Ground temperatures create the necessary environment in which permafrost can form. Williams (1970) offers a comparison between permafrost regions and temperate zones, which is shown here as Figure 3.19. The segment above the permafrost table is called the active zone because it freezes and thaws with each seasonal weather change. The permafrost zone remains constant. The active zone is significant because supra-permafrost ground water exists in it.

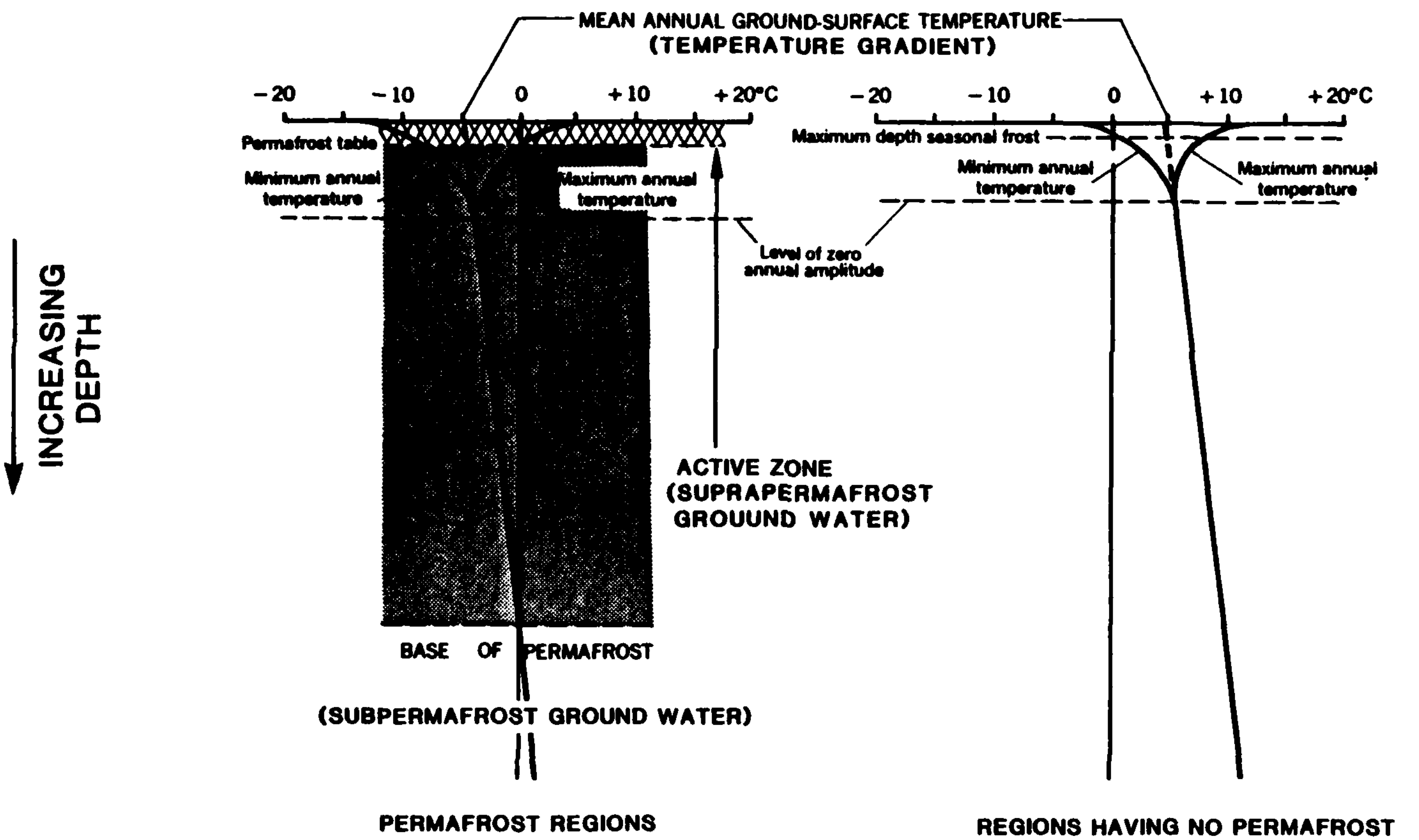
Surface features may have dramatic impacts on the subsurface distribution of permafrost as they influence heat transfer. Heat flow through surface water is greater than through land. Permafrost may be discontinuous or absent near lar e bodies of water such as rivers or deep lakes. Smaller bodies of water may effect the configuration of the permafrost surface or the total thickness of the condition at any given point. Figure 3.20 is a generalized representation of the relationship of surface features to the underlying permafrost.

Péwé (1975) reported that certain types of ground surface features may be utilized to indicate the presence and continuity of permafrost in a given area. Pingos, conical ice-cored hills, 65 to 1300 feet in diameter and 30 to 230 feet high form when massive layers of ice develop near land surface in permafrost. Closed system pingos develop in the level, continuous permafrost areas generally north of the Arctic Circle when unfrozen ground water migrates under pressure to a site, forcing the permafrost to dome upward, forming a large mound. Open system pingos are common to the discontinuous permafrost zone and are the smaller of the two, forming in sloping areas at the bases of hills due to the penetration of the permafrost by ground water under high hydraulic pressure, which in concert with crystallization pressure, arches the overlying materials to form a mound. Pingo distribution is shown on the Permafrost Zones Map, Figure 3.12.

A knowledge of surface features and their relationship to subsurface conditions (the study of geomorphology) can be employed to approximate the existence of permafrost. Geophysical techniques, especially electrical resistivity and seismic refraction may be utilized to delineate permafrost zones (Williams, 1970) when used in concert with direct subsurface sampling methods. Once the configuration of the permafrost zone has been defined, the investigator will have a reasonable under-

AAC NORTHERN REGION

GENERAL TEMPERATURE RELATIONSHIP OF PERMAFROST

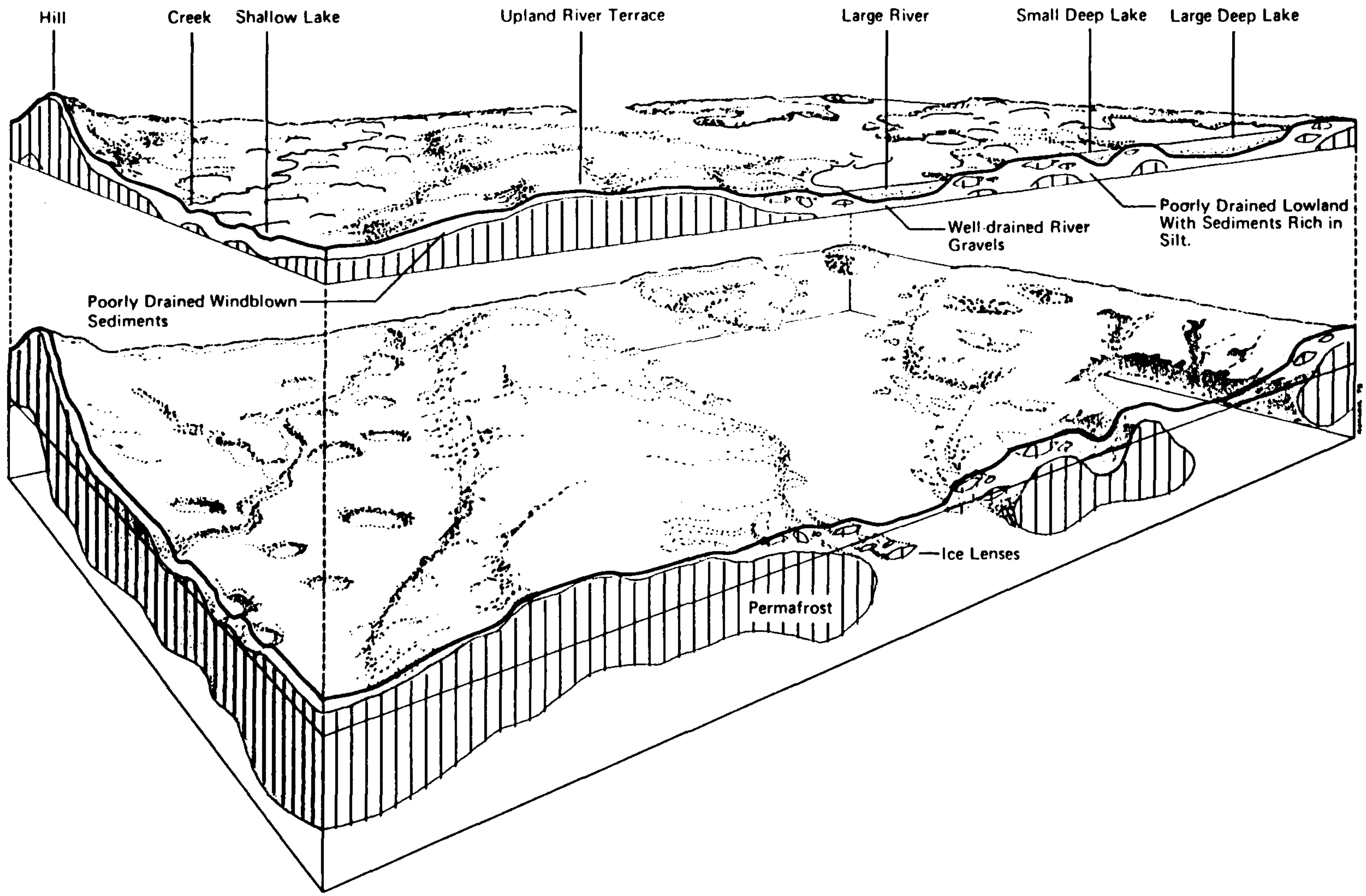


SOURCE: MODIFIED FROM WILLIAMS, 1970

FIGURE 3.20

AAC NORTHERN REGION

SURFACE FEATURE IMPACTS ON PERMAFROST DISTRIBUTION



SOURCE: MODIFIED FROM SELKREGG, 1976c

standing of the potential ground-water resources available in a particular area. Also, such information may be employed to plan the locations of monitoring wells for ground-water quality studies.

Ground-Water Recharge, Discharge and Movement

In Alaska, as in most areas of the world, precipitation is the primary source of ground-water recharge. Alaska's extreme climatic variations have a major impact on this phenomenom, as noted previously. Zenone and Anderson (1978) report that most recharge occurs beneath the reaches of stream channels that lose flow to underlying aquifers. Williams (1970) adds that recharge also occurs beneath lakes and summits and slopes of low hills. These authors also surmise that most discharge takes place in a like manner, i.e: from aquifers to gaining streams or other water bodies through permeable zones, faults, fractures, solution channels, etc. They further estimate that some 25 percent of interior Alaska's streamflow is contributed by baseflow. It is believed that perforating taliks extending partially or even completely through permafrost zones along major river channels facilitate recharge and discharge in the continuous permafrost zone. Subpermafrost water is normally fresh, indicating a surface source and circulation. The effect of permafrost in the discontinuous permafrost zone (Figure 3.12) is not quite so pronounced. While the storage capacity of major alluvial aquifers may be reduced by the presence of permafrost, the entire water-bearing zone is not completely frozen (permafrost thickness is normally less than the total aquifer thickness). Therefore, water can usually be obtained from that portion of the aquifer above or beneath the permafrost zone. This may not be true for coastal areas, where brackish water may under lie the permafrost zone.

The discharge of ground water in permafrost regions may be indicated by the presence of pingoes (described previously) or in winter, by icings. Icings or ice fields form where water seeps upward from the ground, streams, springs, etc. They are caused by the successive freezing of thin water sheets into thick masses of surface ice. Persistent icing development may be taken to indicate the perennial discharge of ground water locally.

Ground-water movement is controlled by permafrost. It acts as a barrier to downward percolation and to lateral movement and also as a

confining layer to subpermafrost water. Confined subpermafrost water usually has an equipotential surface within the permafrost zone, but locally, the static level may be above land surface (Williams, 1970). The low ground-water temperatures effect water movement. It has been shown that water existing under low temperature ranges (0-4.5°C) moves more slowly than ground water in temperate regions due to higher viscosity (velocity is inversely proportional to viscosity) (Williams, 1970).

INSTALLATION WATER SUPPLIES

The following discussion summarizes the water supply data for the individual installations included within the scope of this study. Data has been obtained from USGS-WRD, USAF and published sources.

Galena AFS

Galena AFS obtains its water supplies from two 200 (+) feet deep primary wells constructed into the alluvium of the Yukon River channel, presumably beneath any permafrost that may have been encountered. A third deep well is used to provide fire protection water and two shallow wells are used to furnish water for sanitary uses. Galena AFS well data is summarized in Table 3.4. The locations of the Galena AFS wells are shown in Figure 3.21. The adjacent Village of Galena also obtains its water supplies from wells. The numbers, locations and depths of the Village wells are uncertain. It is presumed that the Village wells are shallow (50 feet deep or less). Due to the position of the Village of Galena with respect to the station, it is assumed that all the Village wells are situated hydraulically downgradient from the installation.

Several installation test borings (uncased holes) encountered ground water in the alluvium at depths ranging from 14 to 21 feet below land surface. USGS test wells drilled at the installation recorded water levels in the range of 26.75 to 30.5 feet below grade during March 1963. It is assumed that the various dates of measurement, river stage and spring thaw conditions may all have effected the observed water levels. For the purposes of this study, it is assumed that water levels on the order of 14 to 30 feet below grade are reasonable for shallow water bearing zones in the river alluvium at Galena AFS. The alluvium consists of poor to well-graded gravel and sand. Some silty zones were

TABLE 3.4
GALENA AFS WELL DATA

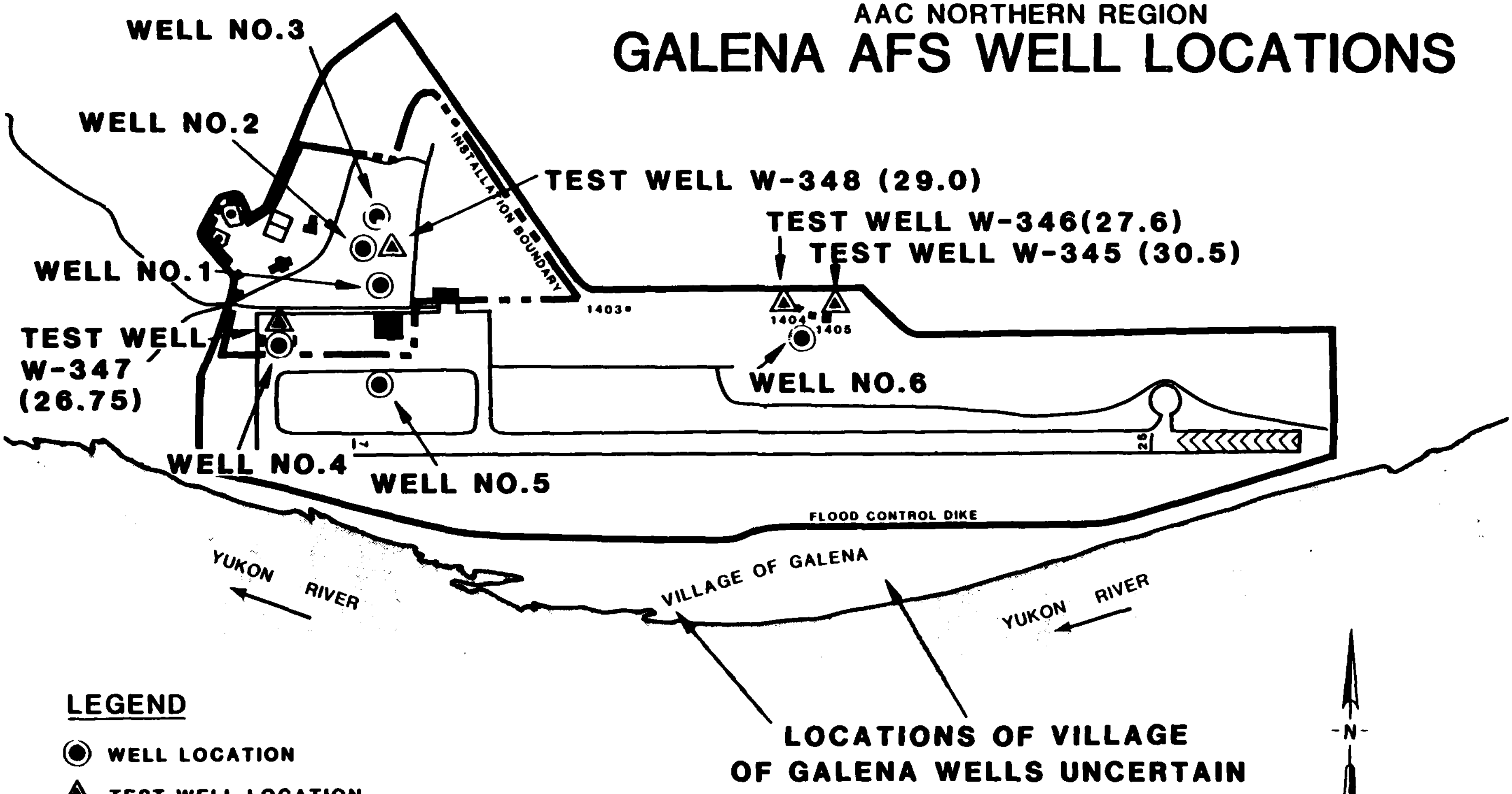
	Well No. 1	Well No. 2	Well No. 3	Well No. 4	Well No. 5	Well No. 6
Location	Bldg. 1549	Bldg. 1578	Bldg. 1812	Bldg. 1428	Bldg. 400	Bldg. 1401
Depth (feet)	205	210	200	210	43	50
Casing Diameter (inches)	6	8	6	8	4	6
GPM(open flow)	130	--	500	--	10	10
Drawdown	10.83	4.4	4.4	--	--	--
Static Water Level (feet below surface)	80	196	196	Unknown	14.6	35
Pump	Myers	Layne & Bowler	Fairbanks-Morse	Jacuzzi	Unknown	Jacuzzi
Model	Submersible	Submersible	Turbine	Submersible	Unknown	Submersible
Horsepower	5	5	25	3/4	Unknown	1/2
Date of Installation	1963	1956	1956	1955	1954	1963
Remarks	--	--	--	Capped	--	--
Condition & Use	Operational	Operational Main Water Supply	Standby Fire Protection	Inactive	Operational Sanitary Water Only	Operational Sanitary Water Only

Source: Installation Documents dated January 1974. Reliability of data is uncertain.

FIGURE 3.21

AAC NORTHERN REGION

GALENA AFS WELL LOCATIONS



LEGEND

- WELL LOCATION
- TEST WELL LOCATION

(30.5) INDICATES DEPTH BELOW GRADE IN FEET OF WATER LEVEL IN USGS TEST WELL IN MARCH, 1963.

SOURCE: MODIFIED FROM INSTALLATION DOCUMENTS AND USGS FILE DATA.

encountered by wells at the station (Figure 3.14). These materials range in permeability from low to very high. Liquids or leachate may reasonably be expected to percolate downward to alluvial water-bearing zones quickly during spring-summer months, but would not necessarily do so during winter months. Liquid movement during the winter months would be governed by the frost layer; most fluids would be expected to remain at or near ground surface and flow overland to drainage channels or until freezing.

Campion AFS

Campion AFS, an inactive installation, is located on a high terrace overlooking the Yukon River floodplain. Campion AFS formerly obtained its water supplies from two deep wells screened into the river alluvium. Thick permafrost, on the order of 382 feet, was encountered during the construction of installation Well No. 2 (USGS-WRD file data, undated). Both wells fully penetrate this layer and derive water supplies from sand and gravel zones beneath it. The water obtained from the deep sand and gravel zones was reported to rise to a point 263.7 to 272.1 feet below grade, measured in July 1969. Table 3.5 summarizes the well construction data for Campion AFS. The locations of the Campion AFS wells are shown in Figure 3.22.

Cape Lisburne AFS

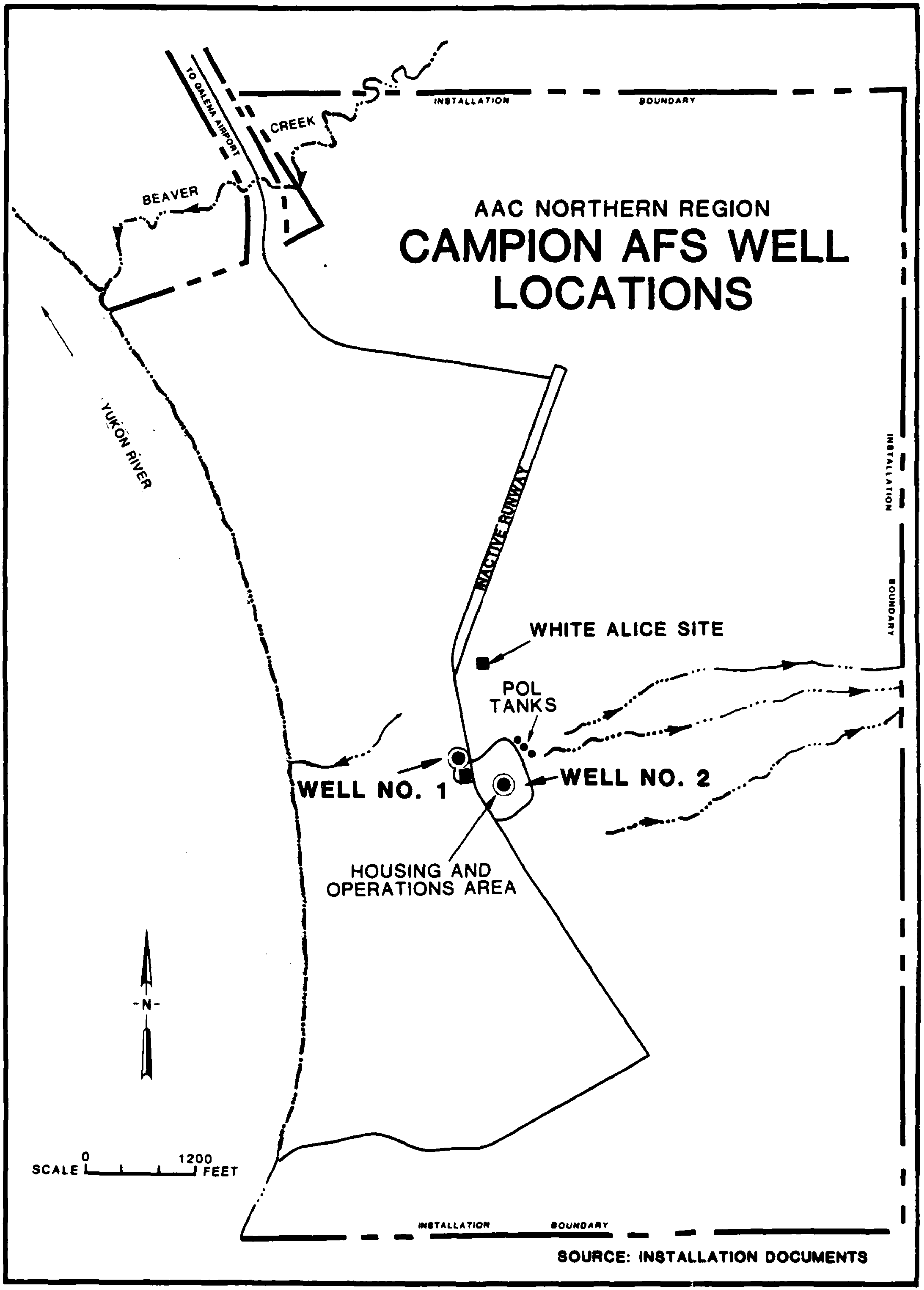
The geology of the Cape Lisburne AFS Lower Camp and airfield area consists primarily of talus and alluvial fan deposits that have washed downslope from the parallel north facing ridges of the Lisburne Hills. A tundra surface layer mantles the coastal lowland. A mixture of talus and alluvium has accumulated in the stream valley of Selin Creek, a 2.5 mile long intermittent stream which drains northward from the highlands to the Chukchi Sea. The stream channel sediments have been determined to be 40 feet thick at the site of a test well drilled in 1976. The Selin Creek hydrologic regime is controlled by the cold arctic climate. The depth of summer thawing in undisturbed ground ranges from 1 to 4 feet; during winter, seasonal frost penetrates completely to the top of underlying permafrost. The total thickness of permafrost at Cape Lisburne is not known, however, at Cape Thompson, 50 miles south, a similar environmental setting exists which has produced a permafrost layer approximately 1,200 feet thick (Feulner and Williams, 1967). Due

TABLE 3.5

CAMPION AFS WELL DATA

	Well No. #1	Well No. #2
Location	Bldg. 129	Bldg. 115
Depth (feet)	425.4	414.5
Casing Diameter (inches)	6	8
GPM (Open Flow)	50	52.5
Drawdown (feet) (July 1969)	2.0	3.6
Static Water Level (July 1969) (feet below grade)	263.7	272.1
Pump	Jacuzzi Submersible	Sta-Rite Submersible
Model	7556J5	40P6K3-2
Horsepower	10	7-1/2
Cycle	60	60
Phase	3	3
Amperage	206	223
RPM	--	3450
Installation	24 July 1969	17 July 1969

Source: Installation Documents


AAC NORTHERN REGION
CAMPION AFS WELL LOCATIONS
TO GALENA AIRPORT
CREEK
BEAVER
INSTALLATION BOUNDARY
YUKON RIVER
INACTIVE RUNWAY
WHITE ALICE SITE
POL TANKS
WELL NO. 1
WELL NO. 2
HOUSING AND OPERATIONS AREA
N
SCALE 0 1200 FEET
INSTALLATION BOUNDARY
SOURCE: INSTALLATION DOCUMENTS

to the unfavorable conditions prevalent at Cape Lisburne, the development of a reliable water supply proved to be difficult. U.S. Geological Survey Water Resources Division scientists formulated an innovative solution to the problem by lowering the permafrost table in the alluvium to establish a dependable ground-water reservoir. The methods utilized to lower the permafrost table included:

- Stripping the tundra vegetation and upper few feet of alluvium to increase the seasonal temperature variation in the sediments.
- Constructing a dam and reservoir to recharge warm surface water in summer by leakage into the alluvium.
- Installing an infiltration gallery downstream of the dam to increase water circulation through the alluvium.
- Snow fences were installed to provide for the accumulation of insulating snow over the gallery, and steam heating pipes were placed in and above the gallery to preclude winter freezing.
- A subsurface ground-water dam was established downstream of the gallery by constructing a snow-free road fill across the stream bed. Deep subsurface winter freezing below the road precludes down valley ground-water flow, maintaining subsurface storage between the seasonal frostline and the lowered permafrost table.

Pumping of the gallery after seasonal streamflow has stopped produced an unsaturated permeable zone through which early spring melt water could percolate into the alluvual aquifer. The gallery system is used in conjunction with surface storage to provide annual water supplies. Figure 3.23A is a diagrammatic cross section of the Cape Lisburne AFS gallery. Figure 3.23B depicts the location of the gallery.

Fort Yukon AFS

The Fort Yukon AFS facility is situated on a low terrace overlooking Yllota Slough, a minor channel of the Yukon River. The installation draws its needed water supplies from a single well installed to a depth of 38 feet into the river channel alluvium. Presumably, the well is screened into sand and gravel strata beneath the surface. The static

AAC NORTHERN REGION

FIGURE 3.23A

CAPE LISBURNE AFS NEW GALLERY CROSS SECTION

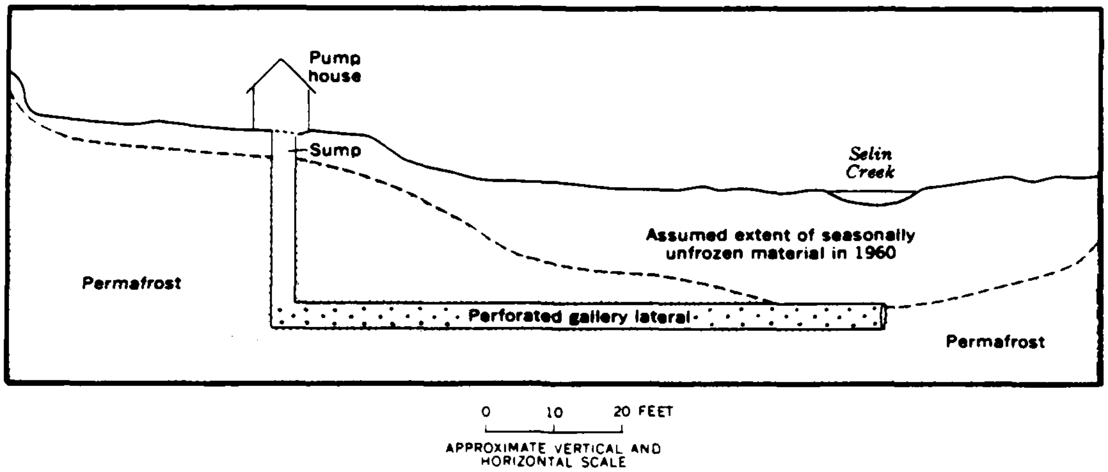
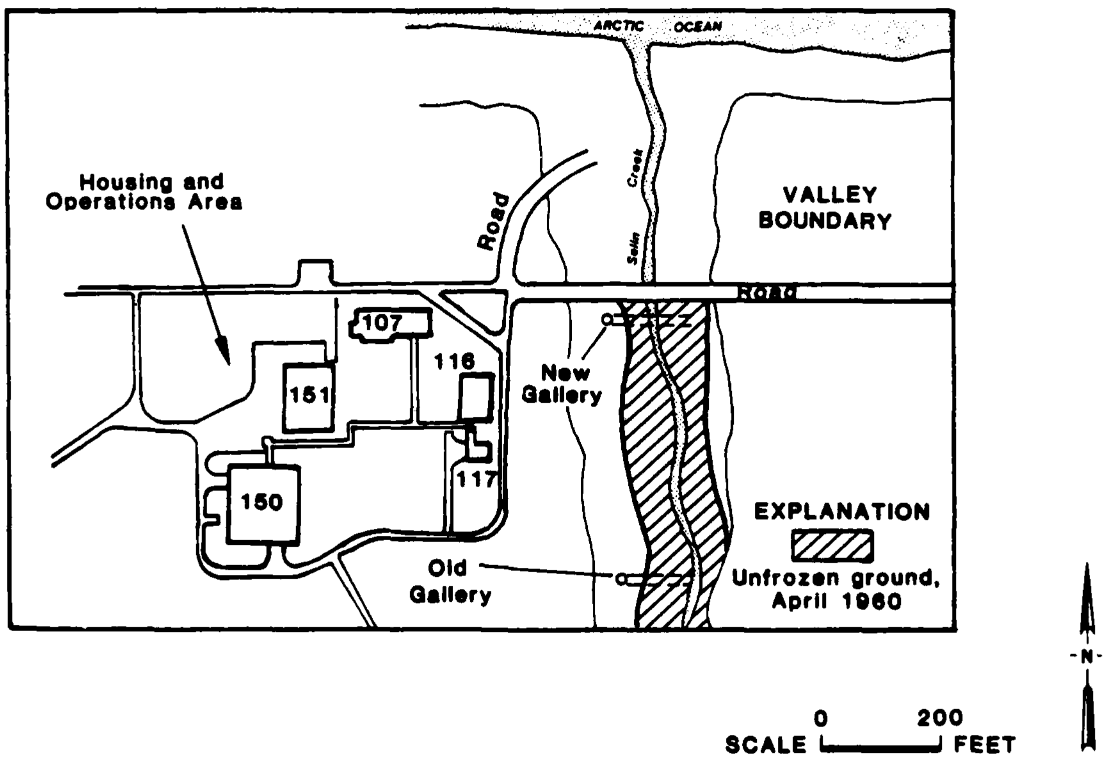


FIGURE 3.23B

CAPE LISBURNE AFS GALLERY LOCATION



SOURCE: MODIFIED FROM FEULNER AND WILLIAMS, 1967

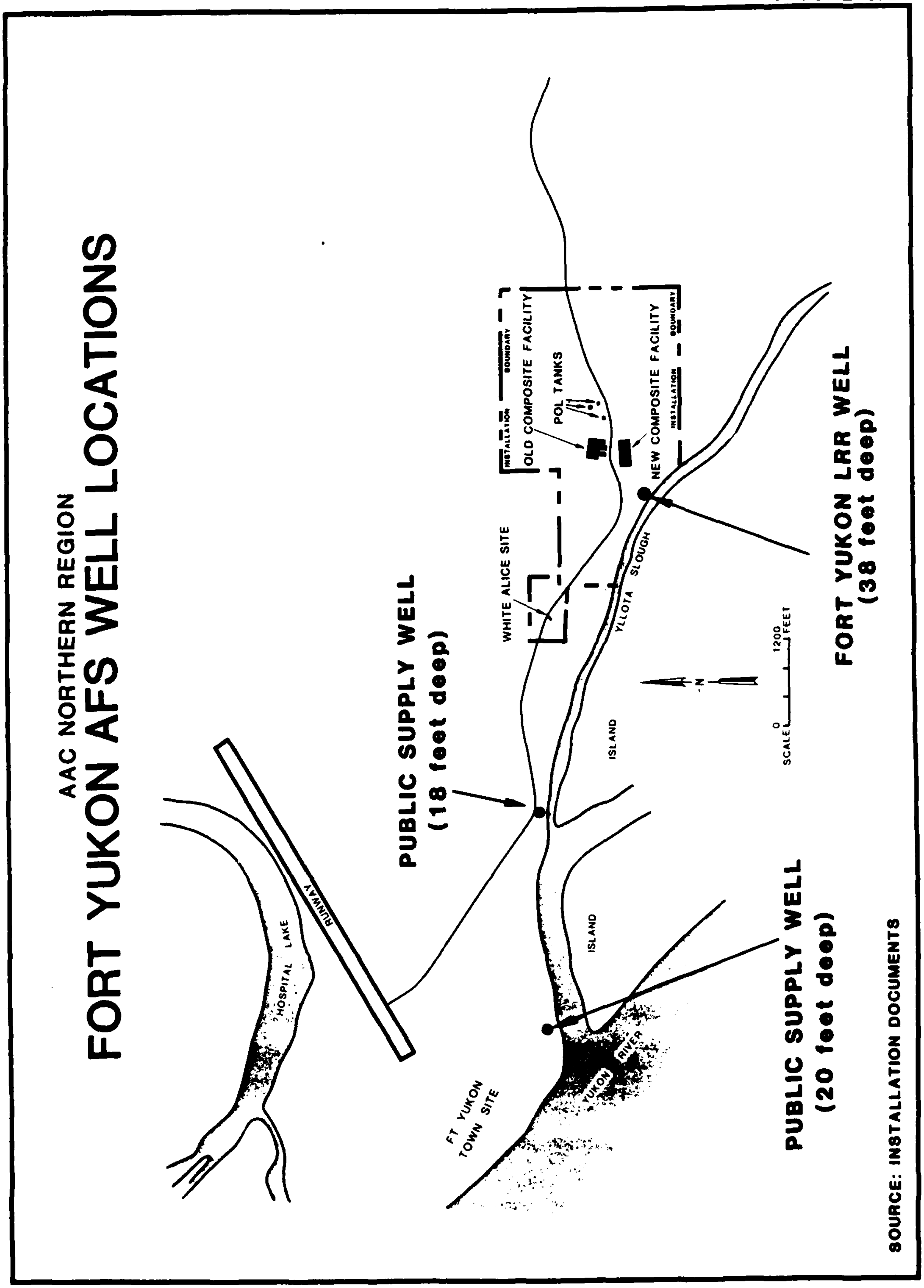
ES ENGINEERING-SCIENCE

water level in the well is uncertain, but is believed to be close to the elevation of surface water in the Yukon River. The nearby Town of Fort Yukon is located about one mile west (downstream) from the installation. The Town is reported to utilize two galleries (a type of shallow well) to obtain its water supplies. Figure 3.24 illustrates the location of the Fort Yukon AFS well and the Town of Fort Yukon galleries (wells). The entire Fort Yukon physical area is similar to that of Galena AFS and the adjacent Village of Galena. Both installations are situated on generally permeable (spring-summer months) unconsolidated sediments. Ground-water flow is thought to be toward Yllota Slough with respect to the base during the spring-summer period. Contaminants allowed to spill or leak onto ground surface may reasonably be expected to percolate downward into the shallow aquifer, estimated to be 20 to 30 feet below land surface or less at the installation. Once contaminants enter the shallow aquifer, they would likely be transported by advection with ground-water flow to the nearest point of discharge, which may be the Town gallery.

Indian Mountain AFS

The hydrogeology of the Indian Mountain AFS is dominated by alluvium of the Indian River and its tributaries. Alluvium, consisting of stratified silt, sand and gravel deposits cover the valley floor. They are estimated to be greater than 25 feet thick. The spring-summer season ground-water level in the alluvium is likely determined by the river stage (shallow). The area is situated in a section of interior Alaska where the permafrost thickness varies from thin to moderately thick and may even be absent locally. The precise permafrost conditions at the Indian Mountain AFS are uncertain. The hydrogeology of the Upper Camp consists of thin residual sand, gravel and cobble deposits overlying bedrock at shallow depths. Some of the north and northeast slopes of Indian Mountain are overlain by glacial materials (Reger, 1979). Ground-water occurs in these surficial deposits during the spring-summer melt and thaw cycle. The water flow proceeds downslope in the shallow deposits, either following the bedrock contours or the permafrost table (reported by Ellis, 1978) toward the valley floor below. Virtually all the surficial materials overlying bedrock are quite permeable during the warm season. Any materials lost or spilled will quickly migrate to the

FIGURE 3.24



AAC NORTHERN REGION
FORT YUKON AFS WELL LOCATIONS
INSTALLATION BOUNDARY
OLD COMPOSITE FACILITY
POL TANKS
NEW COMPOSITE FACILITY
INSTALLATION BOUNDARY
WHITE ALICE SITE
YLLOTA SLOUGH
FORT YUKON LRR WELL
(38 feet deep)
N
SCALE 0 1200 FEET
ISLAND
PUBLIC SUPPLY WELL
(18 feet deep)
RUNWAY
HOSPITAL LAKE
ISLAND
PUBLIC SUPPLY WELL
(20 feet deep)
YUKON RIVER
FT YUKON TOWN SITE
SOURCE: INSTALLATION DOCUMENTS

subsurface, later emerging with ground-water discharge to local tributaries of the Indian River. This scenario has been demonstrated several times in recent history by the numerous POL spills that have occurred in the Upper Camp area. The POL flow path downslope provided a unique opportunity to observe the local hydrogeology. Installation water supplies may be at risk to contaminant migration.

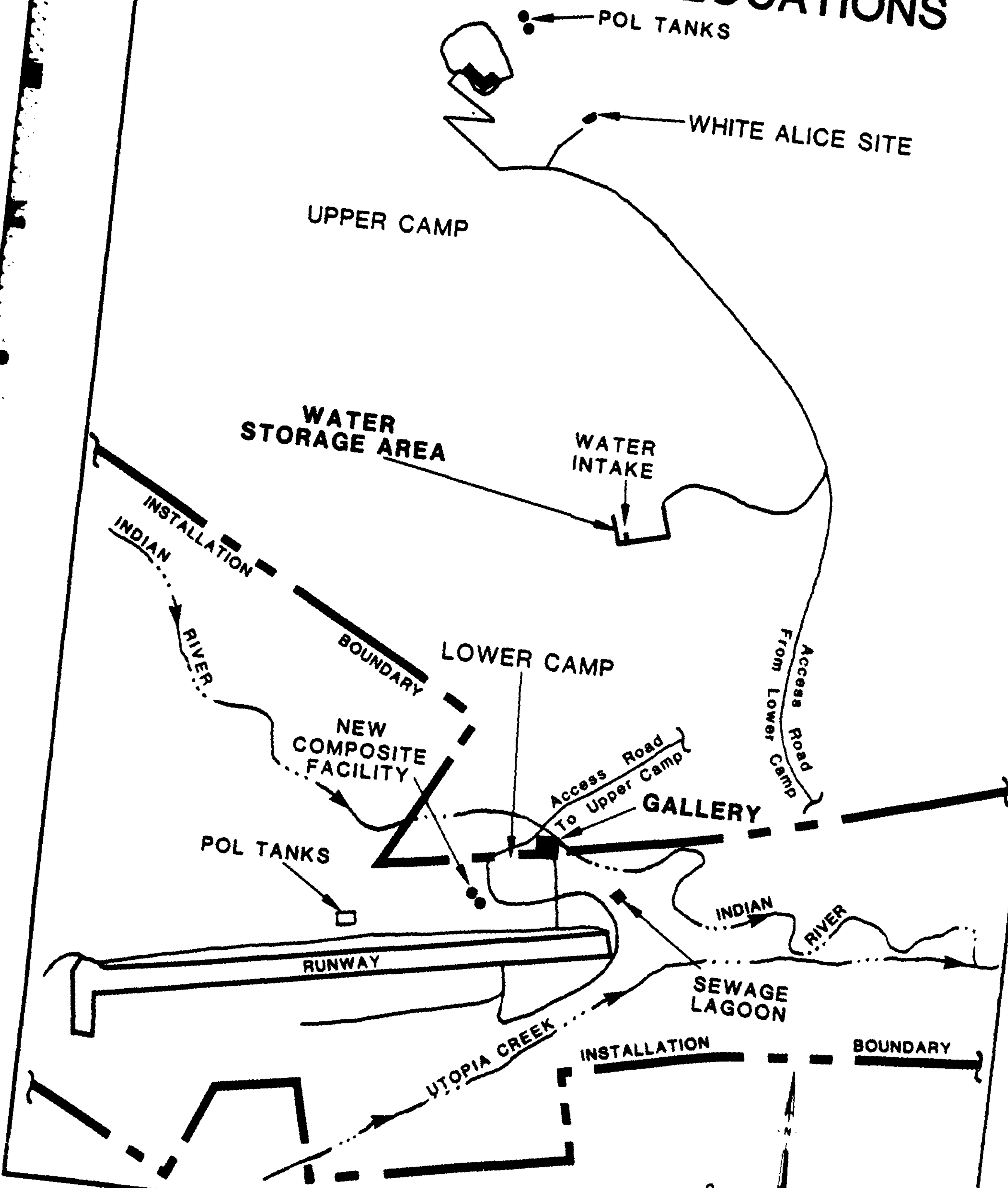
The Indian Mountain Lower Camp obtains its water supplies from a gallery constructed into the alluvium of the Indian River. The Upper Camp obtains its water supplies from a catchment area located on the south slope of Indian Mountain. The catchment area receives shallow ground-water discharge and runoff, for storage and later use. The catchment area is vulnerable to contamination as is the Lower Camp gallery. Indian Mountain AFS water source locations are shown in Figure 3.25.

Kotzebue AFS

The hydrogeology of Kotzebue AFS is dominated by glacial moraine and drift deposits. Permafrost has been reported to exist within a few feet below grade, measured at a USGS test well drilled near the municipal airfield (Williams, 1970). Brackish water is contained in the fine-grained sediments underlying the permafrost. Salinity of the water increases with depth below land surface. This condition has prompted the development of surface water sources to provide for local water requirements. The installation uses a small lake and conjunctive storage to provide water for its needs. The community of Kotzebue uses nearby June Creek as its source of municipal supplies. Some domestic consumers in the study area may employ shallow wells screened into the spit gravel, 4 to 20 feet thick at ground surface to obtain suprapermafrost water, although it is unlikely that this latter choice provides seasonally dependable supplies. The location of the Kotzebue AFS surface water supply system is shown in Figure 3.26. The exact locations of domestic wells relative to the installation are uncertain. In the spring-summer season, the surface sediments of the study area are relatively permeable. Materials allowed to leak or spill onto the surface would reasonably be expected to percolate into the subsurface until reaching the water table (suprapermafrost). Discharge to local surface waters would be expected.

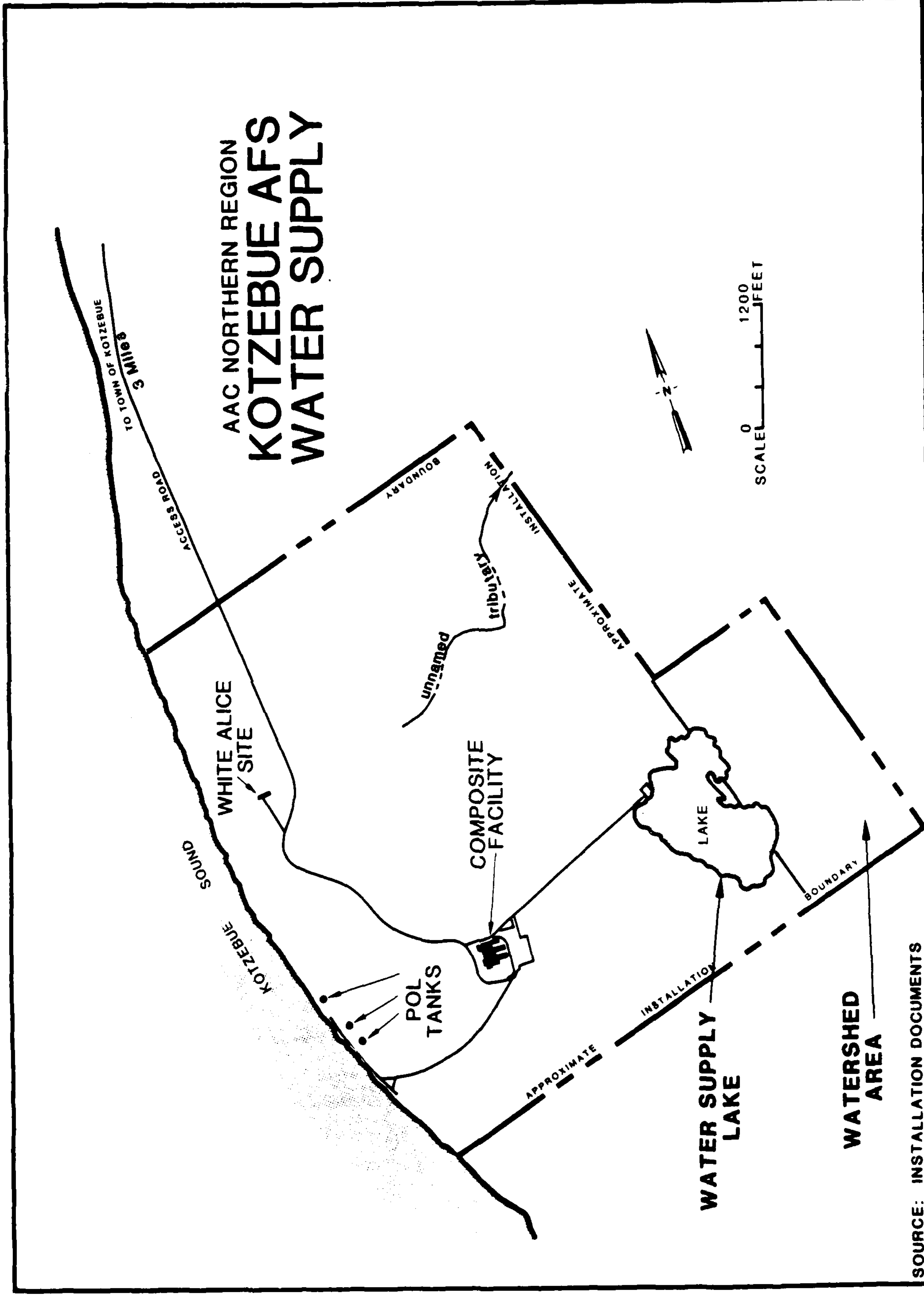
FIGURE 3.25

AAC NORTHERN REGION
INDIAN MOUNTAIN AFS
WATER SUPPLY LOCATIONS



SOURCE: INSTALLATION DOCUMENTS

FIGURE 3.26



AAC NORTHERN REGION
KOTZEBUE AFS
WATER SUPPLY
TO TOWN OF KOTZEBUE
3 Miles
ACCESS ROAD
BOUNDARY
INSTALLATION
APPROXIMATE
unnamed
tributary
WHITE ALICE SITE
COMPOSITE FACILITY
LAKE
KOTZEBUE
SOUND
POL TANKS
APPROXIMATE
INSTALLATION
BOUNDARY
N
SCALE
0
1200
FEET
WATER SUPPLY LAKE
WATERSHED AREA
SOURCE: INSTALLATION DOCUMENTS

Murphy Dome AFS

The hydrogeology of Murphy Dome is dominated by thin residual deposits overlying metamorphic bedrock on the uplands and by relatively thick alluvial deposits in the stream valleys below the dome. Permafrost is discontinuous in the installation study area. Seasonal ground water occurs in the residuum as a result of the melt and thaw cycle; perennial ground water occurs in the stream alluvium. Seasonal ground-water discharge is likely directed downslope to local surface streams from the installation area. Therefore, it would be reasonable to assume that any contaminants spilled or leaked onto ground surface to eventually migrate to local streams. The principal ground-water flow directions probably mirror the area's surface topography: to the north, east and south.

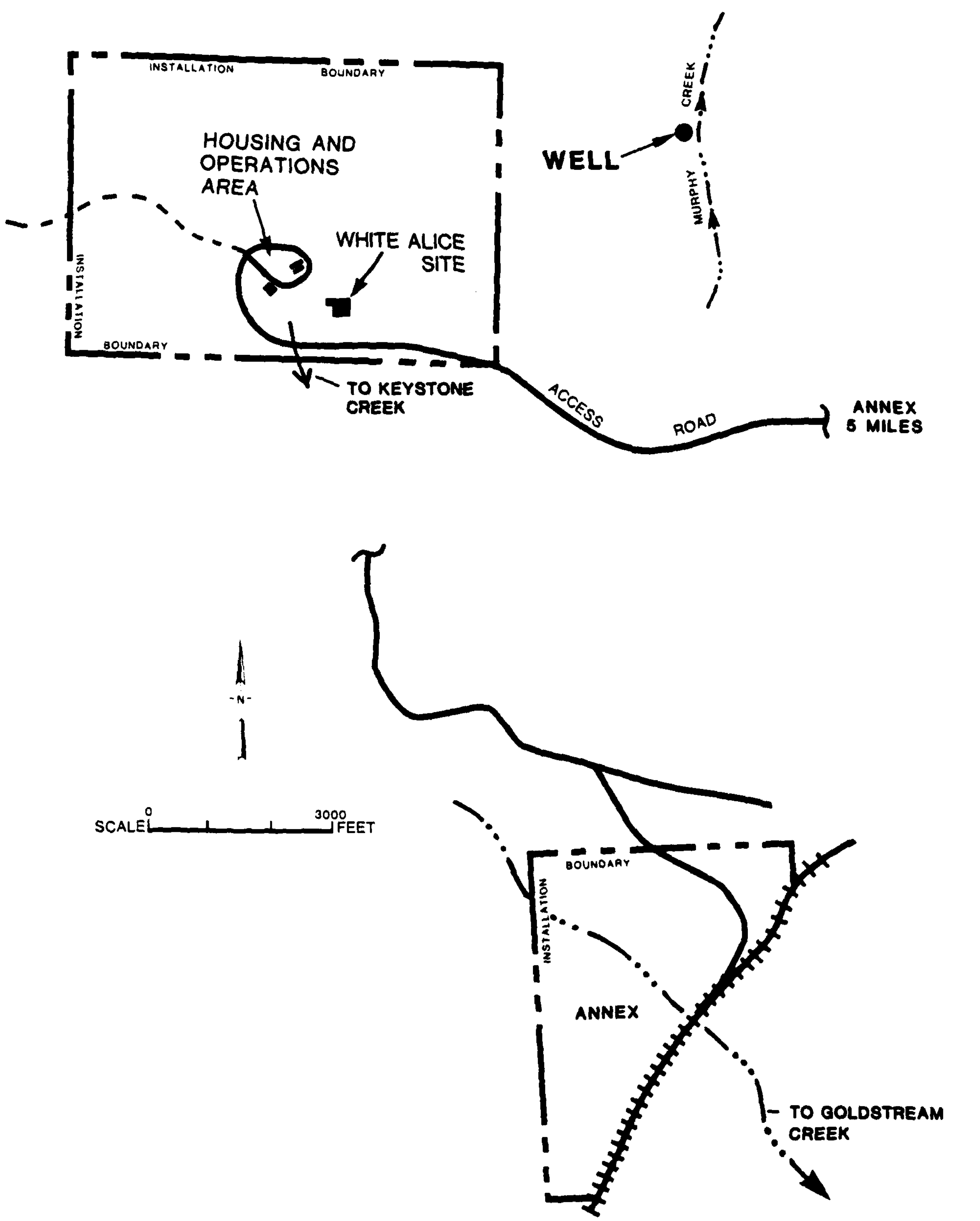
Murphy Dome AFS obtains its water supplies from a single drilled well, 70 feet deep, presumably screened into the alluvium of Murphy Creek, east of the installation. Water is pumped from the well about one mile to a storage tank for later use. The location of the Murphy Dome AFS well is shown in Figure 3.27. Because of its distance from the installation and its depth, the well is probably not vulnerable to minor contaminant losses from Murphy Dome AFS. There are no civilian communities within close proximity to the installation that may be impacted by contaminant migration emanating from the installation.

Tin City AFS

The hydrogeology of the Tin City AFS Lower Camp consists of a thin layer of mixed talus and alluvium overlying bedrock at relatively shallow depths. Virtually all the materials present are silt, sand, gravel, cobbles and boulders that have been deposited downslope from Cape Mountain. The Upper Camp area is underlain by a thin veneer of residium including sand, gravel and cobbles and bedrock. The installation water supply consists of one supply well and a gallery. The well has been installed into fractured zones of the granitic bedrock. The gallery has been constructed to intercept ground water flowing along a fault zone (Feulner, 1966). Water is pumped from the well and gallery to storage and later use as required. The adjacent community of Tin City obtains its water supplies from wells.

FIGURE 3.27

AAC NORTHERN REGION
MURPHY DOME AFS WELL LOCATION



SOURCE: INSTALLATION DOCUMENTS

Any contaminants leaking or spilled onto ground surface in the installation study area during the spring-summer months would likely percolate downward to the water table through the highly permeable talus and alluvial materials. Subsequent discharge to local surface waters is considered probable. The community of Tin City is located approximately 2000 feet southeast of the installation. Due to the location of the Tin City AFS Lower Camp with respect to the community of Tin City, it is anticipated that installation waste management activities may have an adverse impact on local community water supplies.

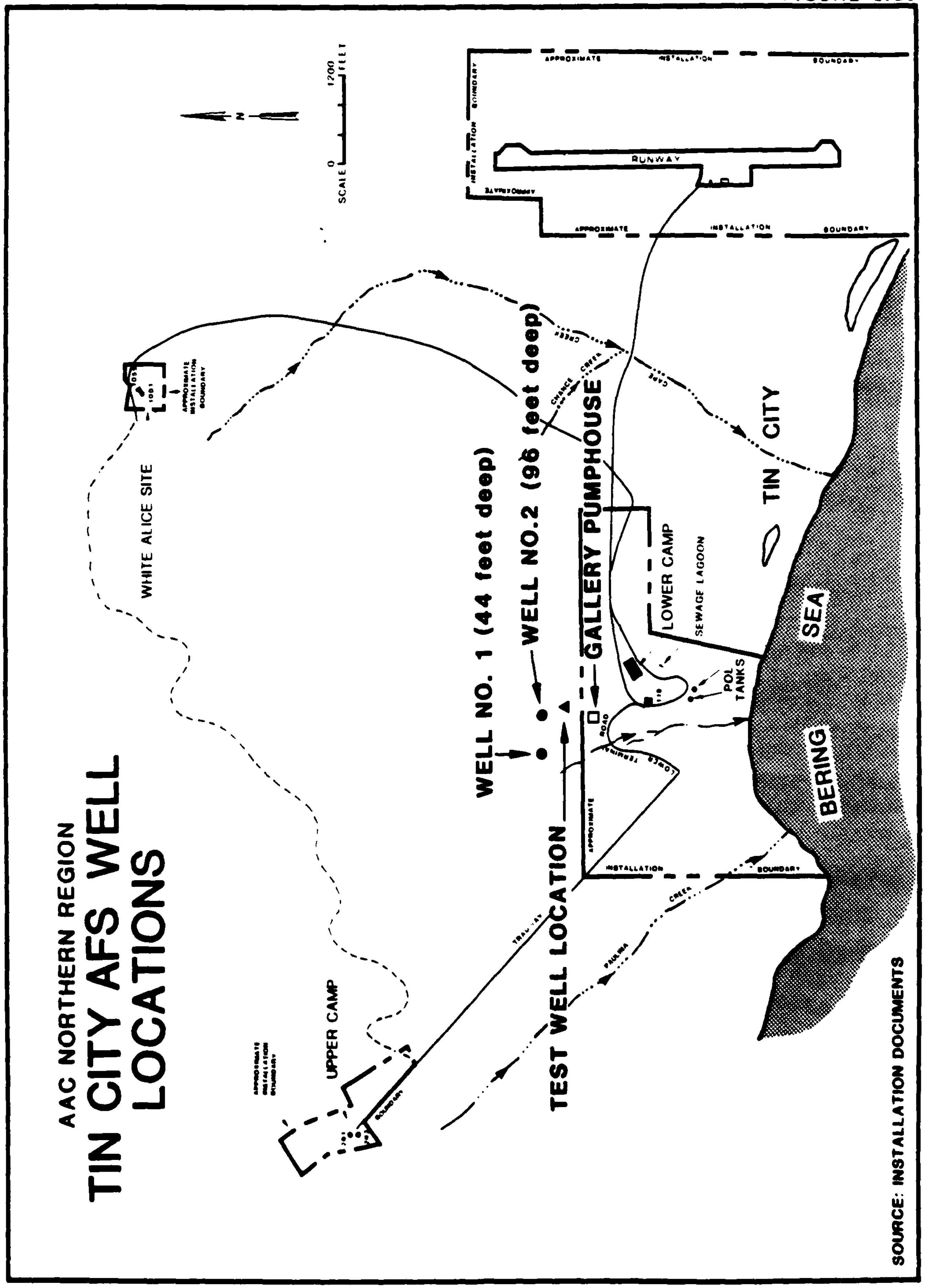
The location of the Tin City AFS well and ground-water collection gallery are shown in Figure 3.28.

Ground-Water Quality

Information describing the ground-water quality characteristics of the installations included within the scope of this study was obtained from installation documents, Feulner (1966); Hawkins (1976) and Hawkins, et al. (1982). Additional historical ground-water quality data was kindly furnished by the U.S. Geological Survey, Water Resources Division Subdistrict Office, Anchorage, Alaska.

The quality of ground-water supplies obtained for consumption at AAC Northern installations has been good, according to historical USGS and USAF information reviewed for this study. The only identifiable problems have been iron, hardness and total dissolved solids concentrations observed at Galena AFS and Campion AFS. These constituents have been present in objectionable, but not harmful concentrations due to natural conditions. Because of regional ground-water quality problems (documented by Williams, 1970), related to local hydrogeology and permafrost considerations, surface water supplies are favored over ground-water sources in the Kotzebue AFS study area. Hawkins (1976) and Hawkins, et al. (1982) reported the presence of arsenic in ground water and other media in the Ester Dome area (near the Murphy Dome AFS study area) of Alaska. Arsenic concentrations of up to 10 parts per million were encountered in the ground water near Ester Dome, a residential section near Fairbanks. The source of the arsenic occurring in local ground water was identified as the geologic units in which the water circulated (bedrock aquifers). No dangerous arsenic levels were noted in Murphy Dome AFS water supplies.

FIGURE 3.28



SOURCE: INSTALLATION DOCUMENTS

Ground-water contamination of shallow aquifers is suspected at Cape Lisburne AFS and Kotzebue AFS due to known POL product spills that have occurred in past years. Contamination has not been confirmed by detailed site-specific studies.

Test borings performed in June 1984 at the Galena AFS aircraft control tower construction site encountered POL products in a shallow water-bearing zone of the major regional aquifer (the Yukon River channel alluvium). It is significant to note that the construction site where POL contamination was encountered was formerly a state-permitted drummed POL product and solvent storage area. It has also been reported that water wells serving the adjacent air passenger terminals have been abandoned due to POL contamination. This last point confirms the contamination of the regional aquifer. The extent of contamination has not been determined.

Severe shallow aquifer contamination is known to exist at Indian Mountain AFS. Seepage of POL products has been observed for several years at the Lower Camp. Large-scale subsurface contamination by POL at the Indian Mountain Upper Camp was described by Ellis (1978) and further documented by Environmental Systems Corporation (1981). Apparently, the POL products were spilled at the Upper Camp and have been seeping down the mountainside, transported in the local shallow aquifer to the Lower Camp vicinity below. No attempt has been made to determine the severity or extent of the contamination.

SURFACE WATER RESOURCES

The surface waters of the State of Alaska have been classified in accordance with their present or potential utilization in order to maintain the highest quality standards possible. The classification system makes distinctions between inland and marine waters and further subdivides these broad categories. The detailed explanation is presented in the document entitled Water Quality Standards (Alaska Department of Environmental Conservation, 1979). The classifications of waters receiving discharge of runoff or effluent from AAC Northern installations is as follows:

1. Fresh waters
   - 1A Water supply
   - 1B Water recreation
   - 1C Aquatic life and wildlife propagation
2. Marine waters
   - 2A Water supply (aquaculture, seafood processing, etc.)
   - 2B Water recreation
   - 2C Aquatic life and wildlife propagation
   - 2D Consumptive harvesting of raw aquatic life

The specific surface waters to which discharges from AAC Northern installations are directed are summarized in Table 3.6. All of the fresh water streams occurring in the study area are classified for high quality as above in 1. The marine waters occurring adjacent to the coastal installations are assigned the high quality use classifications given in 2 above.

Several large-scale losses of POL products have been documented in past years. The major fuel losses have occurred at Kotzebue AFS and Indian Mountain AFS. Suspected POL and solvent losses may have occurred at Cape Lisburne AFS and Galena AFS. In all four cases, surface waters located downslope of the leakage points have probably received some POL products, thus degrading water quality locally. The extent of the water quality degradation is unknown.

BIOTIC RESOURCES AND THREATENED OR ENDANGERED SPECIES

The eight AAC Northern installations studied are widely dispersed throughout northern Alaska. Of the eight installations, only two facilities are located within or proximate to a wildlife refuge, sanctuary, habitat or other natural pristine area:

- o Cape Lisburne AFS: located within the Alaska Maritime National Wildlife Refuge, a federally-protected pristine natural area.

TABLE 3.6
INSTALLATION RECEIVING STREAMS

Installation	Initial Receiving Stream	Major Receiving Stream
1. Galena AFS	Undesignated ditches	Yukon River
	Undesignated ditches	Wetland north of installation
2. Campion AFS	Unnamed streams	Lakes and wetlands east of installation
	Unnamed tributaries	Yukon River
3. Cape Lisburne AFS	Overland flow to Selin Creek	Arctic Ocean
	Unnamed streams	Arctic Ocean
4. Fort Yukon AFS	Undesignated ditches	Yllota Slough/Yukon River
	Undesignated ditch	Wetland north of base
5. Indian Mountain AFS		
(a) Upper Camp	Overland flow to unnamed tributaries	Notoniono Creek
		Indian River
(b) Lower Camp	Overland flow to Utopia Creek	Indian River
	Overland flow	Indian River
6. Kotzebue AFS	Overland flow	Kotzebue Sound
	Overland flow	Wetland east of installation
7. Murphy Dome AFS	Unnamed tributary	Dawson Creek
	Unnamed tributary	Keystone Creek
	Unnamed tributaries	Murphy Creek
8. Tin City AFS	Overland flow to Pauline Creek	Bering Sea
	Overland flow to unnamed stream	Bering Sea

Note: Drainage information for the subject installations is shown in Figures 3.3 to 3.10.

Source: Environmental Systems Corporation (1981), Installation Documents and USGS 1:63,360 Series Topographic Maps

- o Fort Yukon AFS: situated within the boundaries of the Yukon Flats National Wildlife Refuge, a federally-controlled, pristine natural area.

All of the eight installations studied are located within areas providing suitable habitat to a wide range of birds, small game and large game, none of which are considered to be threatened or endangered species.

There are no threatened or endangered species in residence at any of the installations studied. A single bird, the Peregrine Falcon, may, however, be a transient at any time in the Galena AFS and Campion AFS areas. In addition, a Peregrine Falcon nesting site was observed by an Air Force contractor (no date given for the sighting), approximately one mile southeast of the Tin City AFS Upper Camp, at a point located on the southward-facing cliffs overlooking the Bering Sea. Therefore, it is assumed that the falcon could be a transient in the Tin City AFS study area at any time. These conclusions are based on a records search conducted at the offices of the Endangered Species Section, U.S. Fish and Wildlife Service, Region 7, Anchorage, Alaska. In addition to the above, Howard, et al. (1984) report that the falcon may be present at any time at Cape Lisburne AFS, Indian Mountain AFS and Tin City AFS.

SUMMARY OF ENVIRONMENTAL SETTING

The environmental setting data reviewed for this investigation indicate that several significant items are relevant to the evaluation of past hazardous waste disposal practices at the AAC Northern installations. A generalized discussion is presented below. Table 3.7 summarizes the principal environmental concerns relative to each specific installation. In addition to the above, Howard, et al. (1984) report that the falcon may be present at any time at Cape Lisburne AFS, Indian Mountain AFS and Tin City AFS.

- o Precipitation distribution across the state is highly variable. The greatest amounts of precipitation are measured on the coastal mountain ranges; the least amounts are measured in the interior lowlands. No values have been published for the amounts of annual precipitation that may be available for

TABLE 3.7
SUMMARY OF ENVIRONMENTAL CONCERNS

Installation	Potential Environmental Receptors					
	Wetland	Surface Soil	Surface Water	Shallow Aquifer	Regional Aquifer	Threatened or Endangered Species
1. Galena AFS	Yes	Yes	Yes	Yes	Yes	Yes
2. Campion AFS	Yes	Yes	Yes	Yes	Yes	Yes
3. Cape Lisburne AFS	No	Yes	Yes	Yes	No	No
4. Fort Yukon AFS	Yes	Yes	Yes	Yes	Yes	No
5. Indian Mountain AFS	No	Yes	Yes	Yes	No	No
6. Kotzebue AFS	Yes	Yes	Yes	Yes	No	No
7. Murphy Dome AFS	No	Yes	Yes	Yes	No	No
8. Tin City AFS	No	Yes	Yes	Yes	No	Yes

Source: Engineering-Science

infiltration at the various AAC installations. It is assumed that at least one inch of annual precipitation is able to percolate through surface soils and recharge local aquifers.

- Most installation surface soils have been described as being generally permeable. Permafrost has been shown to have a major impact on soil permeability. The seasonal conditions existing at each installation are highly variable. Seasonal frost penetrating surface soils at installations such as Fort Yukon AFS, Cape Lisburne AFS and Kotzebue AFS would do so to the permafrost table rendering all surficial materials relatively impermeable until the next melt and thaw cycle. Discontinuous permafrost present at Galena AFS and Campion AFS would be expected to impact surface soil permeability locally, especially during the winter season.
- A shallow aquifer, probably in hydraulic communication with local surface waters, exists at all eight facilities. All or at least a part of each installation is likely situated within the recharge zone of the respective shallow aquifers.
- A regional aquifer (Yukon River alluvium) is present at Galena AFS, Campion AFS and Fort Yukon AFS. The regional aquifer probably receives some of its recharge from the over-lying installation land areas. No regional aquifers were determined to be present at the remaining five sites.
- The regional aquifer at Galena AFS (Yukon River channel alluvium) is contaminated by POL products and/or solvents.
- The shallow aquifers underlying Kotzebue AFS and Indian Mountain AFS have been confirmed as being contaminated by POL product losses from the installations. The shallow aquifer at Cape Lisburne AFS may have been contaminated by past POL spills.
- The surface waters receiving discharge from the seven active installations are classified for high water quality and use standards.
- No endangered or threatened species of plants or animals is known to be in residence at any of the installations included within the scope of this study. The Peregrine Falcon could,

however, be a transient at Galena AFS, Campion AFS or Tin City AFS.

- Wetland areas have been identified at or adjacent to Galena AFS, Campion AFS, Fort Yukon AFS and Kotzebue AFS. The wetland areas are receiving runoff and sewage effluent discharge from these installations.

From these major points, it may be seen that pathways for the migration of hazardous waste-related contamination or POL loss exist at all of the installations evaluated. Contamination could be directed to local surface waters via runoff or direct discharge, or to shallow and/or deep aquifers, continuing to migrate beyond installation boundaries. Due to Alaska's delicate environmental setting, the long-range impacts could be severe. The potential impact on public health is not known.

SECTION 4
FINDINGS

This section summarizes the hazardous wastes generated by installation activities, identifies hazardous waste accumulation and disposal sites located on the installation, and evaluates the potential environmental contamination from hazardous waste sites. Past waste generation and disposal methods were reviewed to assess hazardous waste management practices at AAC Northern Region Installations.

INSTALLATION HAZARDOUS WASTE ACTIVITY REVIEW

A review was made of past and present installation activities that resulted in generation, accumulation and disposal of hazardous wastes. Information was obtained from files and records, interviews with past and present installation employees and site inspections. Hazardous waste activities that occurred in the vicinity of but off the present installation property were included if they were entirely due to Air Force operations.

The sources of hazardous waste at the installations are grouped into the following categories:

- Industrial Operations (Shops)
- Waste Accumulation Areas
- Fuels Management
- Spills and Leaks
- Pesticide Utilization
- Fire Protection Training

The subsequent discussion addresses only those wastes generated at the installations which are either hazardous or potentially hazardous. Potentially hazardous wastes are grouped with and referenced as "hazardous wastes" throughout this report. A hazardous waste, for this

report, is defined by, but not limited to, The Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). Compounds such as polychlorinated biphenyls (PCBs) which are listed in the Toxic Substances Control Act (TSCA) are also considered hazardous. For study purposes, waste petroleum products such as contaminated fuels, waste oils and waste non-chlorinated solvents are also included in the "hazardous waste" category.

No distinction is made in this report between "hazardous substances/materials" and "hazardous wastes". A potentially hazardous waste is one which is suspected of being hazardous although insufficient data are available to fully characterize the material.

Industrial Operations (Shops)

Summaries of industrial operations at the Alaskan Air Command were developed from installation files and interviews. Information obtained was used to determine which operations handle hazardous materials and which ones generate hazardous wastes. Summary information on all installation shops is provided as Appendix E, Master List of Shops.

For the shops identified as generating hazardous wastes, file data was reviewed and personnel were interviewed to determine the types and quantities of wastes and present and past disposal methods. Information from AAC and installation files and from interviews with installation employees is summarized in Table 4.1, which is located at the end of this discussion. The waste quantities presented in this table are based either on available file data or estimates of present quantities by installation personnel. Waste quantities were generally higher in the past because of the greater level of activity at the installations. Past disposal practices, presented as a timeline, are based on information obtained from former and current installation employees. Although the wastes and waste quantities are presented separately, they were generally commingled prior to disposal.

Galena AFS

Industrial wastes generated at Galena AFS consist mainly of contaminated fuel, waste oil and spent solvents. These wastes are generated from fuel systems operations and maintenance, civil engineering operations, and aircraft maintenance. Contaminated fuel and some other

combustibles have been burned in fire protection training exercises. Some small quantities of wastes went to the off-base landfill. Most of the industrial wastes, particularly oils, have been accumulated during winter months and provided to the State of Alaska for application to the roads during the summer to minimize the extremely fine dust which is characteristic of the area. In 1983-1984 permits for road oiling were no longer issued by the state so wastes have been accumulated prior to barge and/or air shipment to DPDO.

Campion AFS

Most of the industrial liquid wastes from Campion were accumulated and taken to Galena AFS to assist in controlling dust on the installation roads. Some minor quantities of wastes generated at Campion were disposed in the landfills serving the installation.

Cape Lisburne AFS

Industrial wastes generated at Cape Lisburne AFS consist primarily of waste oils and diesel fuel generated from operations in the power plant and the vehicle maintenance shop (see Table 4.1). Smaller quantities of spent solvent and waste paint are also generated. The waste oil and fuel are currently placed in drums and shipped off-base to DPDO at Elmendorf AFB for disposal. The shipment of wastes off-base began in approximately 1977. Prior to approximately 1977, wastes were accumulated in an area adjacent to the existing landfill. In 1977 and 1978, the wastes that had accumulated over the years were shipped off base during a general site cleanup.

Fort Yukon AFS

The majority of the industrial wastes generated at Fort Yukon AFS consist of waste oils and spent solvents generated in the power plant and vehicle maintenance shop. Some of these wastes were applied to on-base and off-base roads for dust control until 1984. Some of the wastes were burned in furnaces by residents of the community of Fort Yukon for heat. The remainder of the wastes were accumulated in a waste storage area until 1982. Since 1982, waste engine oil, ethylene glycol are spent solvents not used for dust control have been shipped to DPDO at Elmendorf AFB for off-base disposal.

Indian Mountain AFS

Wastes generated from industrial operations at Indian Mountian are primarily from vehicle maintenance and power plant activities. Lubricating oils and small amounts of solvents are the principal types of wastes produced. These oily wastes have been accumulated and/or used for many years on the extensive installation road system for dust control and disposal purposes.

Kotzebue AFS

The only active industrial shop that results in the generation of hazardous waste at Kotzebue AFS is the radar maintenance shop. A small quantity of waste oil from the radar gearbox is generated in this shop. The waste oil is collected in a drum for shipment off base. The station support and maintenance shops were closed in 1985. Previously, larger quantities of wastes were generated at Kotzebue AFS. Some of the wastes were used for dust control on roads. Prior to 1974, some of the wastes were accumulated adjacent to a landfill that was located along Kotzebue Sound, north of the POL tanks. The landfill was closed in approximately 1974. When the landfill was closed, drummed wastes that had accumulated over the years were removed from the base. Shipment of waste oil not used for dust control to DPDO was initiated in approximately 1976.

Murphy Dome AFS

Industrial wastes from Murphy Dome shops are similar to other LRR installations including primarily lubricating oils and some solvents from power plant and vehicle maintenance activities. The quantity of waste oil from the power plant at this installation is less than other AFS sites because primary power is provided by a local utility. The boilers are used only for heat and standby power generation.

Murphy Dome is also unique from other AFS sites due to its close proximity to a major community and other military installations. This has resulted in a longer history for transporting wastes to off-base disposal locations. Since approximately 1972, waste oils and other liquids have been generally hauled off the premises. In recent years the waste oils have been combusted in boilers at Fort Wainwright in Fairbanks. Until 1972 wastes were applied to the installation roads for dust control and disposal purposes.

TABLE 4.1

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
GALENA AFS				
VEHICLE/EQUIPMENT MAINTENANCE	1845	LUBRICATING OIL & HYDRAULIC FLUID	500 GALS./YR.	1951 ROAD OILING; 1983 BARGED OFF-BASE (DPDO)
		BATTERIES	30/YR.	OFF BASE (LANDFILL)
		PC 444A	220 GALS./YR.	ROAD OILING; BARGED OFF BASE (DPDO)
POWER & HEATING PLANT	1499	LUBRICATING OIL	6,600 GALS./YR.	ROAD OILING; BARGED OFF BASE (DPDO)
		PD 680	110 GALS./YR.	ROAD OILING; BARGED OFF BASE (DPDO)
		ETHYLENE GLYCOL & WATER	150 GALS./YR.	OFF BASE (LANDFILL)
HEAT/REFRIGERATION SHOP	1842	CUTTING OIL	2 GALS./YR.	TO GROUND/ROAD OILING
PAINT SHOP	1846	PAINTS	10 20 GALS./YR.	OFF BASE (LANDFILL)
RADAR MAINTENANCE	1551	TRANSMISSION FLUID	5 GALS./YR.	ROAD OILING; BARGED OFF BASE (DPDO)
	MAR Tower	GEARBOX OIL	24 GALS./YR.	1984 BARGED OFF BASE (DPDO)
BARRIER MAINTENANCE	1551	HYDRAULIC FLUID	100 GALS./YR.	1955 ROAD OILING; 1983 BARGED OFF BASE (DPDO)
		DIESEL FUEL	5 GALS./YR.	TO GROUND
		LUBRICATING OIL	100 GALS./YR.	ROAD OILING; BARGED OFF BASE (DPDO)
		PD 680	50 GALS./YR.	TO GROUND/ROAD OILING

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

NOTE: WASTES TYPICALLY COMMINGLED BEFORE DISPOSAL

DPDO DEFENSE PROPERTY DISPOSAL OFFICE

MAR MINIMALLY ATTENDED RADAR

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 – 1960 – 1970 – 1980)
GALENA AFS (CONT'D)				
MISSILE MAINTENANCE	1488	HYDRAULIC FLUID, PAINT THINNER & TRICHLOROETHANE	12 GALS./YR.	1957 ROAD OILING; 1983 BARGED OFF-BASE (DPDO)
AGE	1551	HYDRAULIC FLUID	55 GALS./YR.	1951 ROAD OILING; BARGED OFF BASE (DPDO)
		LUBRICATING OIL	135 GALS./YR.	ROAD OILING; BARGED OFF BASE (DPDO)
		SYNTHETIC OIL	40 GALS./YR.	ROAD OILING; BARGED OFF BASE (DPDO)
		JP 4	220 GALS./YR.	FPTA
		MOGAS	220 GALS./YR.	FPTA/ROAD OILING; BARGED OFF BASE (DPDO)
		PD 680	55 GALS./YR.	ROAD OILING; BARGED OFF BASE (DPDO)
AIRCRAFT MAINTENANCE	1428	LUBRICATING OIL	10 GALS./YR.	ROAD OILING; BARGED OFF-BASE (DPDO)
		HYDRAULIC FLUID	20 GALS./YR.	ROAD OILING; BARGED OFF-BASE (DPDO)
		JP 4	50 GALS./YR.	FPTA
FUELS LAB	1837	CONTAMINATED FUEL	5 GALS./YR.	O/W-SANITARY SEWER
CAMPION AFS	----	NO CURRENT WASTE MATERIALS	---- SITE DEACTIVATED	

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

NOTE: WASTES TYPICALLY COMMINGLED BEFORE DISPOSAL

DPDO DEFENSE PROPERTY DISPOSAL OFFICE

FPTA FIRE PROTECTION TRAINING AREA

O/W OIL/WATER SEPARATOR

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
CAPE LISBURNE AFS				
POWER & HEATING PLANT	151	LUBRICATING OIL & DIESEL FUEL	3,000 GALS./YR.	1953 ACCUMULATED/RUNWAY OILING 1973 INCINERATOR/BARGED OFF-BASE (DPDO)
		TRICHOLROETHYLENE	20 GALS./YR.	LANDFILL
PLUMBING SHOP	151	CUTTING OIL	5 GALS./YR.	ACCUMULATED/RUNWAY OILING INCINERATOR/BARGED OFF-BASE (DPDO)
MOTOR POOL	151	LUBRICATING OIL	165 GALS./YR.	ACCUMULATED/RUNWAY OILING INCINERATOR/BARGED OFF-BASE (DPDO)
		ETHYLENE GLYCOL & WATER	110 GALS./YR.	ACCUMULATED/RUNWAY OILING BARGED OFF BASE (DPDO)
		DIESEL FUEL	10 GALS./YR.	ACCUMULATED/RUNWAY OILING INCINERATOR/BARGED OFF BASE (DPDO)
CARPENTRY/PAINT SHOP	151	LATEX & OIL BASE PAINT	150 GALS./YR.	LANDFILL
RADAR MAINTENANCE	150	GEARBOX OIL	20 GALS./YR.	LANDFILL
FORT YUKON AFS				
VEHICLE/EQUIPMENT MAINTENANCE	NCF	LUBRICATING OIL	60 GALS./YR.	1958 ROAD OILING 1984 BARGED OFF-BASE (DPDO)
		HYDRAULIC FLUID	30 GALS./YR.	ROAD OILING BARGED OFF-BASE (DPDO)
		ETHYLENE GLYCOL & WATER	20 GALS./YR.	ROAD OILING BARGED OFF-BASE (DPDO)
		PD 680	55 GALS./YR.	ROAD OILING BARGED OFF-BASE (DPDO)

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

NOTE: WASTES TYPICALLY COMMINGLED BEFORE DISPOSAL

NCF - NEW COMPOSITE FACILITY

DPDO DEFENSE PROPERTY DISPOSAL OFFICE

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
FORT YUKON AFS (CONT'D)				
POWER & HEATING PLANT	NCF, 103	LUBRICATING OIL & CLEANING SOLVENT	360 GALS./YR.	1958 TO GROUND/ROAD OILING 1980 BARGED OFF BASE (DPDO)
		ETHYLENE GLYCOL & WATER	120 GALS./YR.	ROAD OILING; BARGED OFF BASE (DPDO)
RADAR MAINTENANCE	MAR Tower	GEARBOX OIL	20 GALS./YR.	ROAD OILING; BARGED OFF-BASE (DPDO)
INDIAN MOUNTAIN AFS				
VEHICLE/EQUIPMENT MAINTENANCE	NCF, 217	LUBRICATING OIL & HYDRAULIC FLUID	440 GALS./YR.	1953 ROAD OILING; AIRLIFTED OFF BASE (DPDO)
		PD 680	50 GALS./YR.	ROAD OILING; AIRLIFTED OFF-BASE (DPDO)
POWER & HEATING PLANT	NCF, 221	LUBRICATING OIL	1060 GALS./YR.	ROAD OILING; AIRLIFTED OFF-BASE (DPDO)
		ETHYLENE GLYCOL & WATER	250 GALS./YR.	ROAD OILING; AIRLIFTED OFF-BASE (DPDO)
RADAR MAINTENENCE	234	GEARBOX OIL	20 GALS./YR.	ROAD OILING; AIRLIFTED OFF-BASE (DPDO)
KOTZEBUE AFS				
POWER & HEATING PLANT AND VEHICLE/EQUIPMENT MAINTENANCE	103, R 3	LUBRICATING OIL, FUEL, PD 680, ETHYLENE GLYCOL & WATER	2,750 to 4,125 GALS./YR.	1950 ROAD OILING/ACCUMULATED 1975 ROAD OILING/BARGED OFF-BASE (DPDO)

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

NOTE: WASTES TYPICALLY COMMINGLED BEFORE DISPOSAL

NCF NEW COMPOSITE FACILITY

DPDO DEFENSE PROPERTY DISPOSAL OFFICE

MAR MINIMALLY ATTENDED RADAR

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 1960 1970 1980)
KOTZEBUE AFS (CONT'D)				
RADAR MAINTENANCE	203	LUBRICATING OIL	20 GALS./YR.	1950 ROAD OILING/ACCUMULATED; 1975 ROAD OILING/BARGED OFF BASE (DPDO)
MURPHY DOME AFS				
VEHICLE/EQUIPMENT MAINTENANCE	103/104	LUBRICATING OIL & HYDRAULIC FLUID	220 GALS./YR.	1952 ROAD OILING; 1972 TRUCKED OFF-BASE (DPDO)
		ETHYLENE GLYCOL/WATER	55 GALS./YR.	ROAD OILING; TRUCKED OFF-BASE (DPDO)
POWER & HEATING PLANT	110	LUBRICATING OIL	330 GALS./YR.	ROAD OILING; TRUCKED OFF BASE (DPDO)
		ETHYLENE GLYCOL/WATER	110 GALS./YR.	ROAD OILING; TRUCKED OFF BASE (DPDO)
		PD 680	30 GALS./YR.	ROAD OILING; TRUCKED OFF BASE (DPDO)
RADAR MAINTENANCE (USAF & FAA)	211/212	GEARBOX OIL	30 GALS./YR.	ROAD OILING
TIN CITY AFS				
VEHICLE/EQUIPMENT MAINTENANCE	150	LUBRICATING OIL	660 GALS./YR.	1953 OFF-BASE (FURNACES)/RUNWAY OILING; 1981 OFF-BASE (FURNACES)
		PD-680	60 GALS./YR.	OFF-BASE (FURNACES)/RUNWAY OILING; OFF-BASE (FURNACES)
		BATTERIES	6/YR.	LANDFILL

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

DPDO DEFENSE PROPERTY DISPOSAL OFFICE

NOTE: WASTES TYPICALLY COMMINGLED BEFORE DISPOSAL

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 – 1960 – 1970 – 1980)
TIN CITY AFS (CONT'D)				
POWER & HEATING PLANT	110	LUBRICATING OIL	5,460 GALS./YR.	1953 OFF BASE (FURNACES)/RUNWAY OILING - - - - 1981 OFF BASE (FURNACES)
		PD 680	40 GALS./YR.	OFF BASE (FURNACES)/RUNWAY OILING - - - - OFF BASE (FURNACES)
		ETHYLENE GLYCOL & WATER	1,200 GALS./YR.	OFF-BASE/RUNWAY OILING - - - - OFF BASE
RADAR MAINTENANCE	201	GEARBOX OIL	20 GALS./YR.	OFF-BASE (FURNACES)/RUNWAY OILING - - - - OFF-BASE (FURNACES)

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

NOTE: WASTES TYPICALLY COMMINGLED BEFORE DISPOSAL

Tin City AFS

Shops that generate hazardous waste at Tin City AFS are the power plant and the vehicle and radar maintenance shops. The wastes from these shops consist primarily of wastes oil and spent solvent. These wastes have been burned in furnaces off base for heat.

Waste Accumulation Areas

Galena AFS

One major waste accumulation area has been identified at Galena AFS. This area is located at the power plant (Figure 4.1). It has been used since the 1950's to accumulate waste oils from the power operations and wastes generated at other locations, prior to use on the roads for dust control or transport to off-base disposal through DPDO. This site stored drums on the ground until 1984 when a concrete pad with curbing was built to contain any drum leakage. However, a portion of the curb has been broken out at the low point on the pad. During the site visit leakage from drums was draining from the concrete pad to the adjacent ground. Leakage of drums to the ground in this area has likely occurred for many years since oil was extensively evident around the site and a noticeable oil odor existed in the area. In addition, some fuel spills have occurred in this area from the power plant.

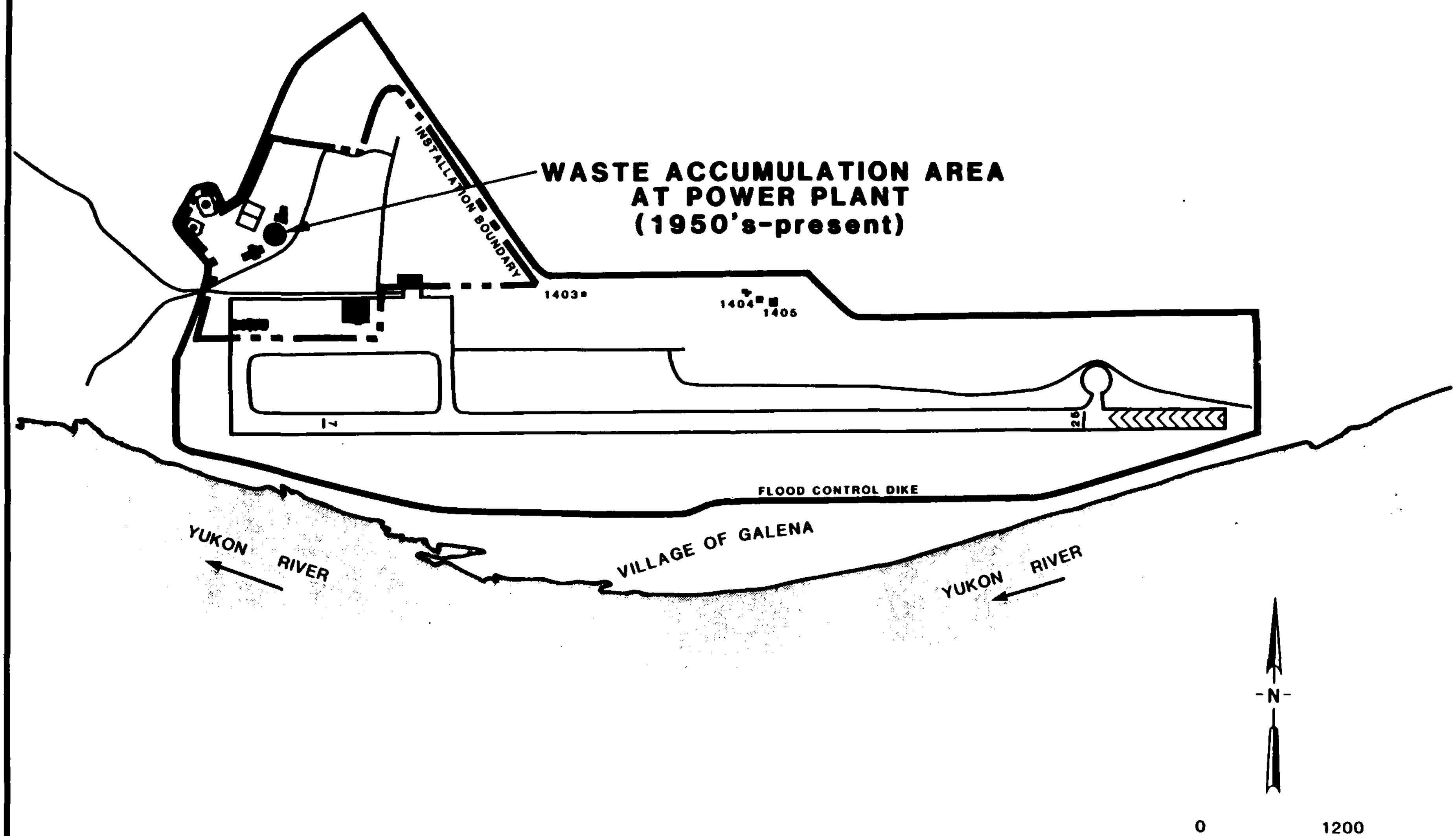
A few other areas (AGE shop and vehicle maintenance) at the installation are used for accumulating three to five drums of wastes prior to moving them to the power plant area. These locations do not show signs of major spillage or leakage.

Campion AFS

Two sites used for some storage of waste materials have been identified at Campion AFS. Most of the POL and other liquid products delivered to the station were hauled to a drum storage area (Waste Accumulation Area No. 1) located 0.25 miles southeast of the housing and operations area (Figure 4.2). Waste Accumulation Area No. 1 was used until Campion was deactivated. The area stored not only unused product but was also employed for storage of drums with liquid wastes. Spillage occurred on the site. The stained top soils were removed during a cleanup at the site in 1983 and placed in the installation landfill.

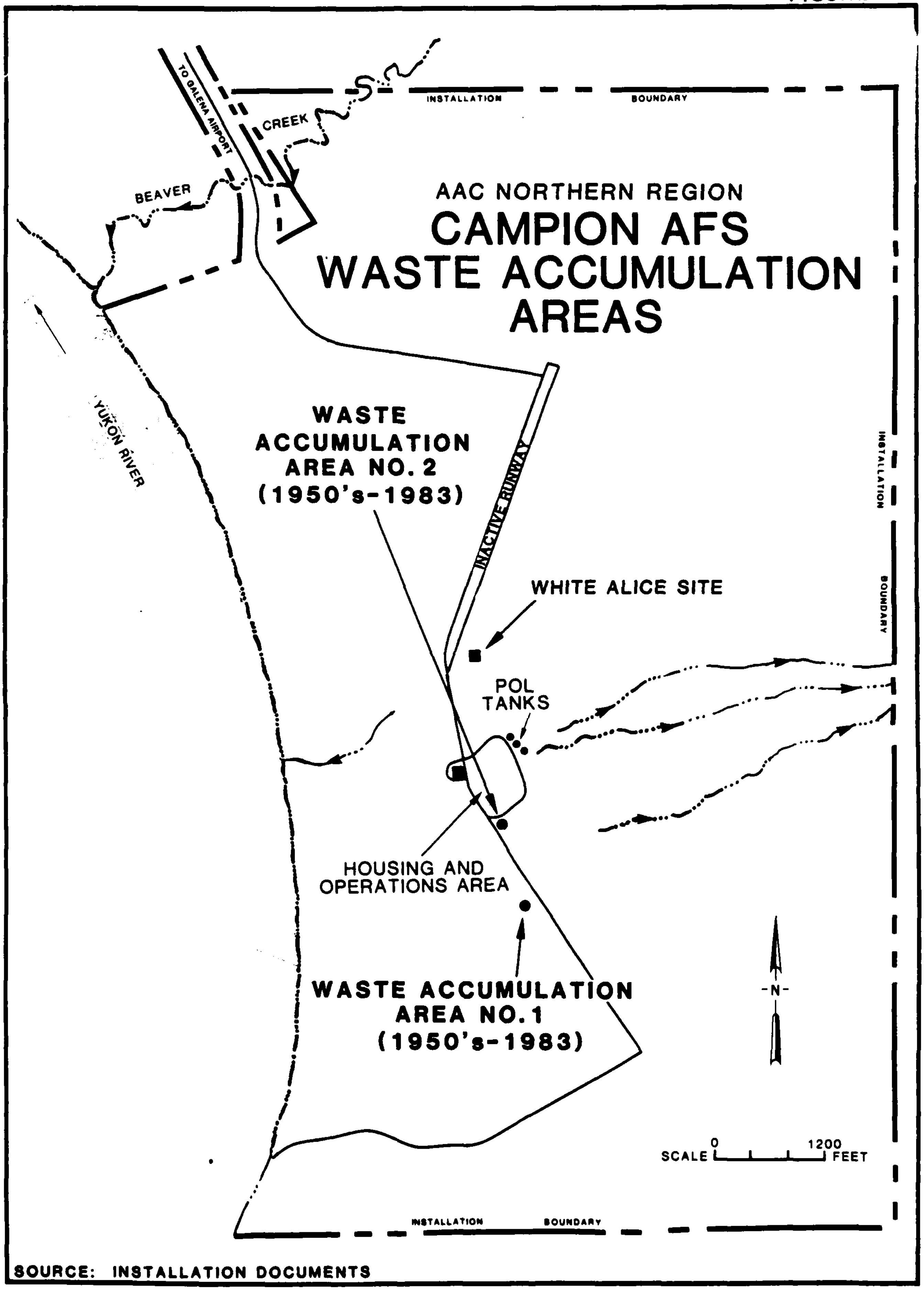
Unused product was periodically moved from the No. 1 site to a drum storage area located near the southeast corner of the camp. This area

AAC NORTHERN REGION
GALENA AFS
WASTE ACCUMULATION AREA



SOURCE: INSTALLATION DOCUMENTS

FIGURE 4.2


AAC NORTHERN REGION
CAMPION AFS
WASTE ACCUMULATION
AREAS
INSTALLATION BOUNDARY
TO GALENA AIRPORT
CREEK
BEAVER
YUKON RIVER
INACTIVE RUNWAY
WASTE ACCUMULATION AREA NO. 2 (1950's-1983)
WHITE ALICE SITE
POL TANKS
HOUSING AND OPERATIONS AREA
WASTE ACCUMULATION AREA NO. 1 (1950's-1983)
N
SCALE 0 1200 FEET
SOURCE: INSTALLATION DOCUMENTS

(Waste Accumulation Area No. 2) was also used for storing drummed waste products. Spillage occurred at this site.

Wastes were briefly stored near the points of generation within the camp (power plant, motor pool) but these areas do not show evidence of extensive storage. It is presumed most waste liquids were drummed and routinely moved to either Waste Accumulation Areas Nos. 1 and 2.

Cape Lisburne AFS

There is one active waste accumulation area (Waste Accumulation Area No. 1) at Cape Lisburne AFS. This site is located along the beach east of the liquid fuel storage area (Figure 4.3). This storage area is adjacent to the road that leads to the supply barge landing area. The drums are stored in this area on gravel prior to shipment on a barge to Elmendorf AFB. There is evidence of small spills and leaks in this area.

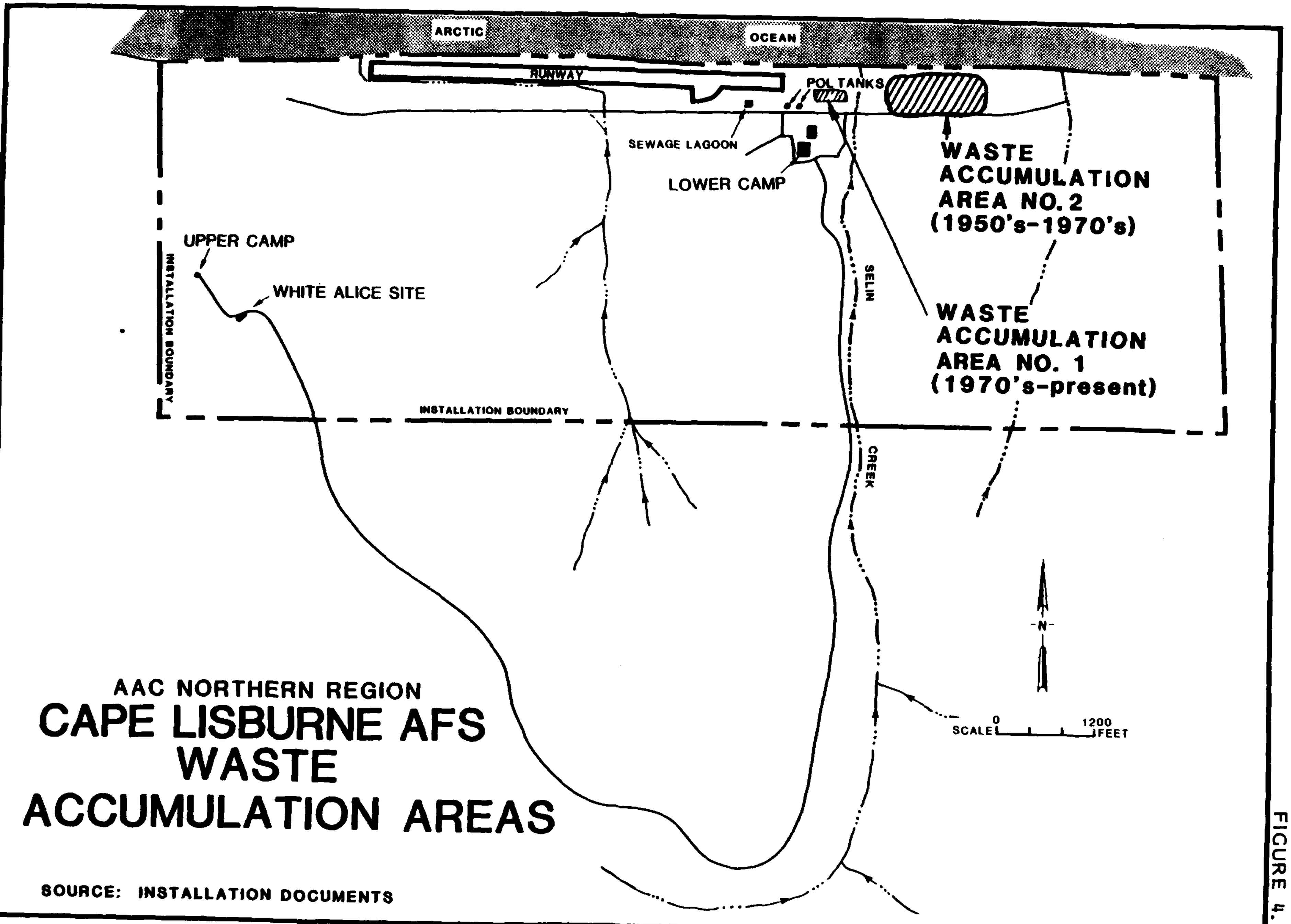
One former waste acumulation area (Waste Accumulation Area No. 2) has been identified at Cape Lisburne AFS. This area was contiguous with the base landfill. Wastes were accumulated in this area until 1977-1978 when they were shipped off base as part of a general site cleanup. During this cleanup, empty drums and other debris were buried in the accumulation area and in the base landfill.

Fort Yukon AFS

There is one waste accumulation area at Fort Yukon AFS (Figure 4.4). This area was used for storage of wastes that had accumulated on the installation over a period of several years. In 1982, 600 to 700 drums of wastes were removed from the area during a general site clean-up. The drums were shipped to Elmendorf AFB for disposal. The wastes are stored in a sandy area. There is some evidence of minor spills and leaks in this area.

Indian Mountain AFS

Currently, one main accumulation area (Waste Accumulation Area No. 1) exists at Indian Mountain for drummed wastes. This is located adjacent to the eastern end of the runway at the Lower Camp (shown in Figure 4.5). Drums are stored on the ground at this location prior to airlifting them to off-base disposal through DPDO. This site was also used for many previous years according to installation photographs. There is evidence of small spills and leaks in this area, although

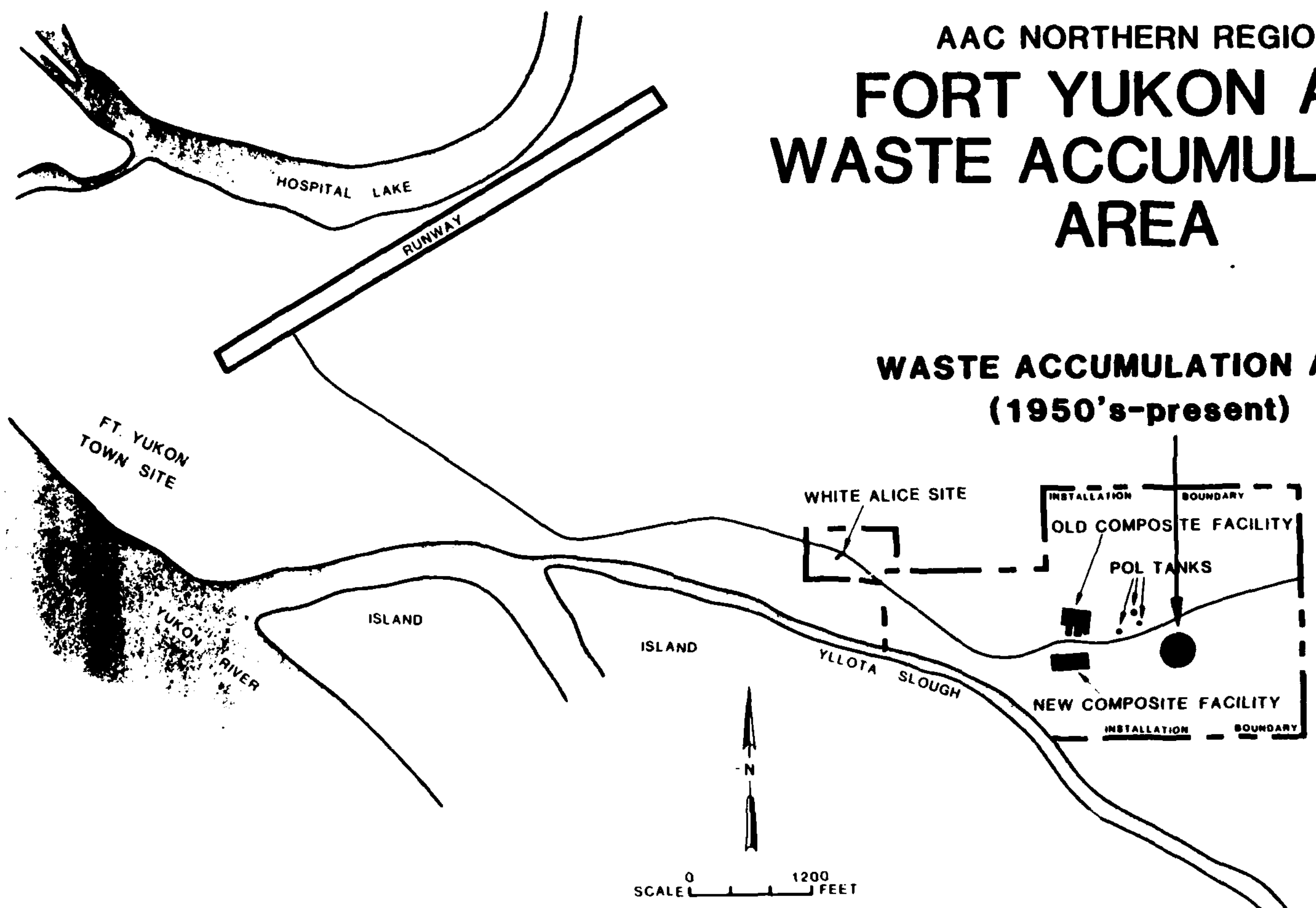


AAC NORTHERN REGION
CAPE LISBURNE AFS WASTE ACCUMULATION AREAS

SOURCE: INSTALLATION DOCUMENTS

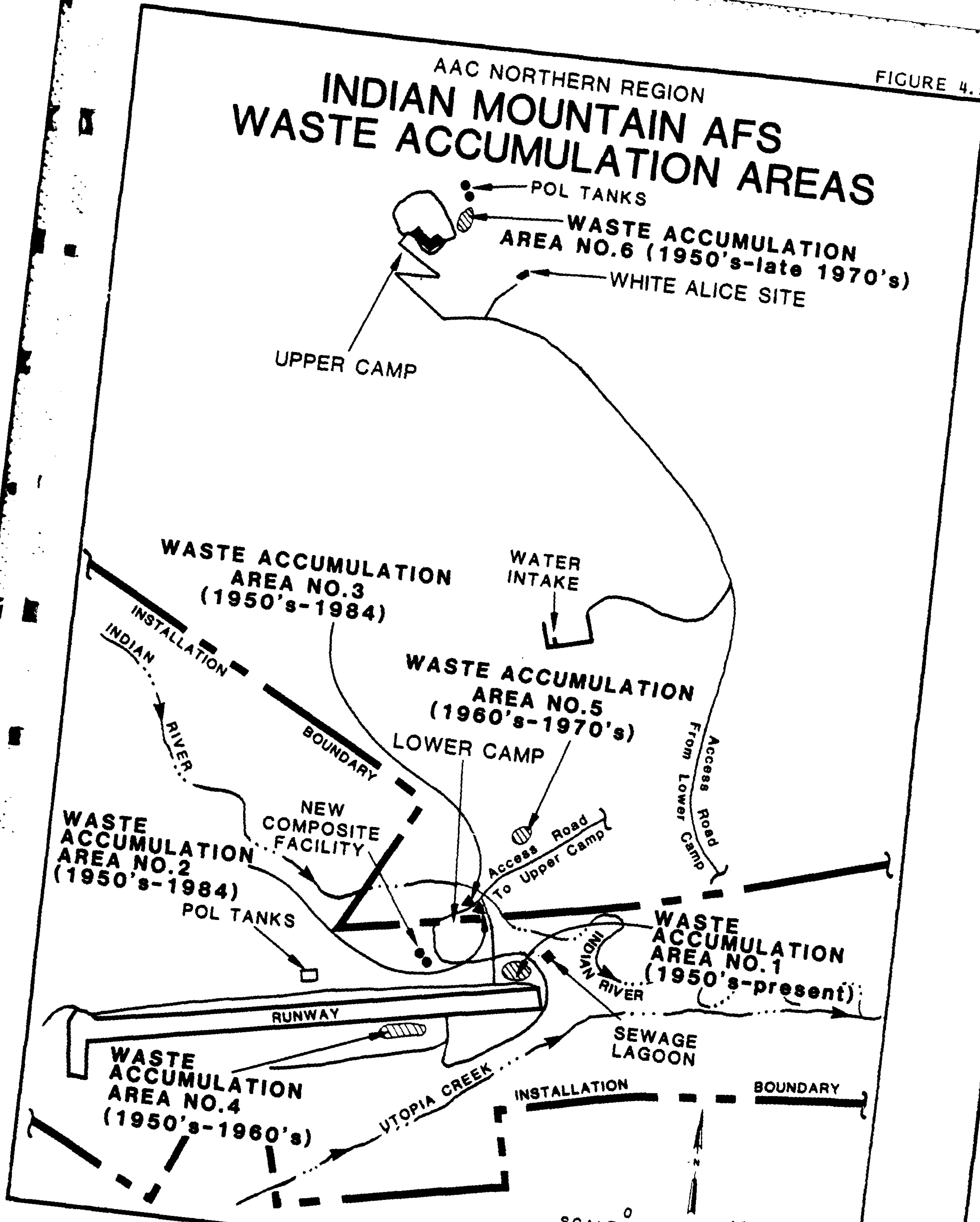
FIGURE 4.4

AAC NORTHERN REGION
FORT YUKON AFS WASTE ACCUMULATION AREA



SOURCE: INSTALLATION DOCUMENTS

FIGURE 4.5



SOURCE: INSTALLATION DOCUMENTS

several heavily contaminated areas had soils removed and taken off base in 1984.

In earlier years of installation operations several other areas were used to accumulate wastes and/or empty drums. The power plant (Building 110) at the Lower Camp operated until 1984 when the new MAR support facility began operations. Waste oils and other liquids from the power plant were either stored adjacent to Building 110 (east side) in drums (Waste Accumulation Area No. 2) or were accumulated in an above-ground tank on the west side of the building (Waste Accumulation Area No. 3). Some soils were removed from this drum storage area in 1984 and taken off the installation.

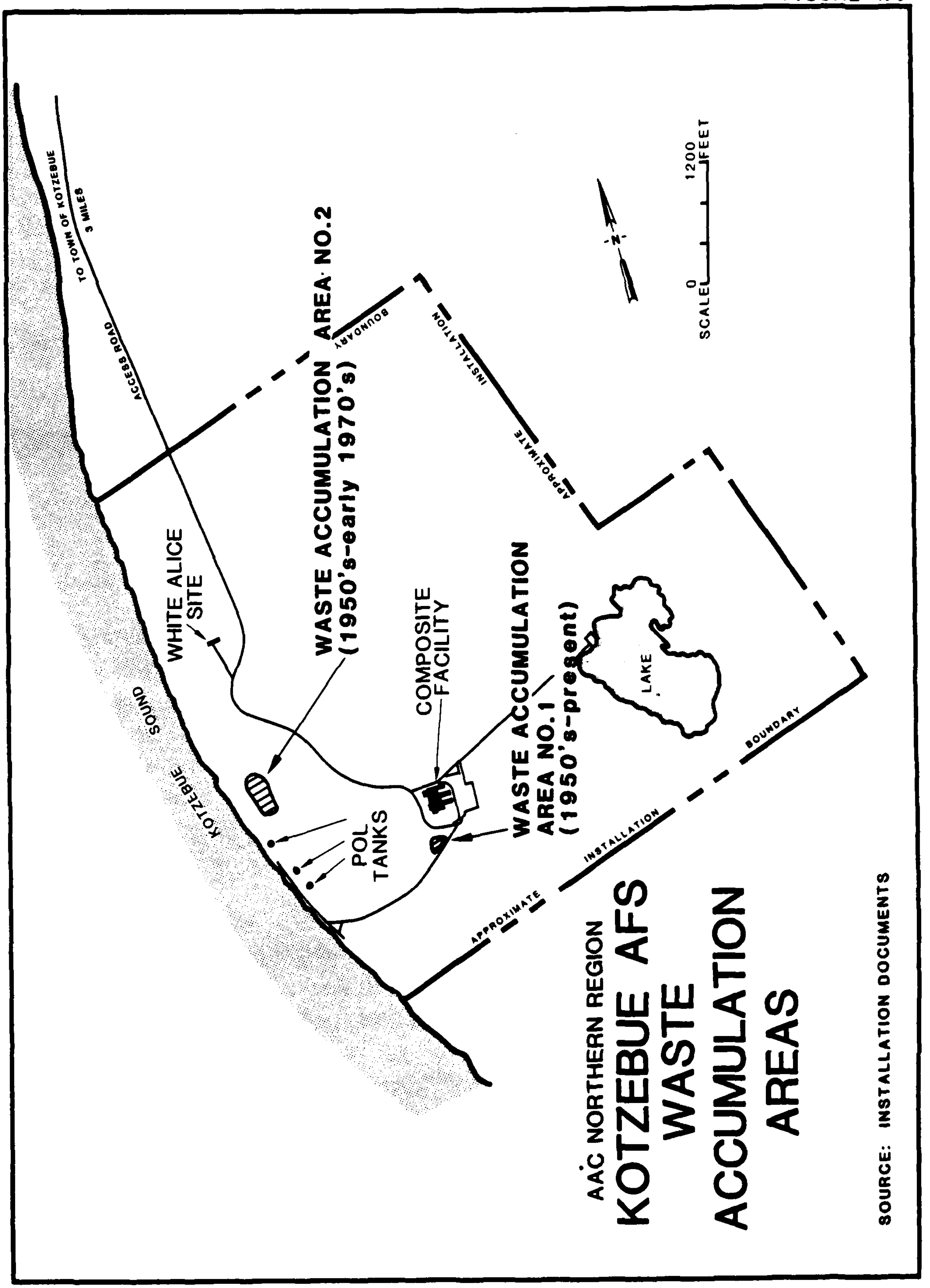
There is also evidence that a large number of drums were at one time accumulated on the south side of the runway (Waste Accumulation Area No. 4). Several barrels remain scattered in the vicinity. Waste Accumulation Area No. 4 may have served as a drum storage area for fuels prior to delivering fuel in bulk quantities and/or it may have stored wastes in drums. Another area used near the Lower Camp to store some wastes was at a site (Waste Accumulation Area No. 5) adjacent to the road leading to the Upper Camp (Figure 4.5). During an installationwide cleanup in 1979-1980 several barrels with some oil were found at this site.

At the Upper Camp there have been a very large number of drums accumulated, many of which contained waste oils and other liquids. Aerial photographs of the site in previous years show that the main barrel accumulation area (Waste Accumulation Area No. 6) was between the POL tank area and the operations and maintenance buildings at the Upper Camp (Figure 4.5). In 1978-1980 a major cleanup on the installation crushed and buried many of the drums that had been accumulated at the Lower and Upper Camps.

Kotzebue AFS

There is one active waste accumulation area (Waste Accumulation Area No. 1) at Kotzebue AFS as shown in Figure 4.6. This storage area is located south of Building No. 205. There were approximately 45 drums marked waste oil stored in this area at the time of the site visit for this study. There is evidence of recent leaks from drums in this area.

FIGURE 4.6



AAC NORTHERN REGION
KOTZEBUE AFS
WASTE
ACCUMULATION
AREAS

SOURCE: INSTALLATION DOCUMENTS

Until the early 1970's, there was a waste accumulation area (Waste Accumulation Area No. 2) along the beach on Kotzebue Sound. The accumulation area was northeast of the fuel storage tanks on the beach. This accumulation area was adjacent to a landfill that was used up to approximately 1972. In approximately 1974, the waste accumulation area and the landfill were cleaned up. The cleanup involved removal of most of the waste oil drums and grading of the site.

Murphy Dome AFS

There is one active waste accumulation area (Waste Accumulation Area No. 1) at Murphy Dome which is located between the power plant (Building 110) and the bulk fuel storage area (Figure 4.7). Waste fluids are stored in drums on the ground behind the dock which stores unused products. Some evidence of leakage exists at this site. Waste oils have also been accumulated in a drum adjacent to the motor pool (Building 103) prior to movement to Waste Accumulation Area No. 1.

An aerial photograph shows an area (Waste Accumulation Area No. 2) northwest of the power plant that was used to store drummed materials. This area was used until 1970 when storage of wastes and unused product was moved to the current site. Another site (Waste Accumulation Area No. 3), apparently used as an accumulation area, was northwest of the present helicopter landing area. In about 1978 when a site cleanup was undertaken approximately 50 drums were found in this area; a few drums were empty (rusted through) but the others contained waste oils. All drums were removed from the installation.

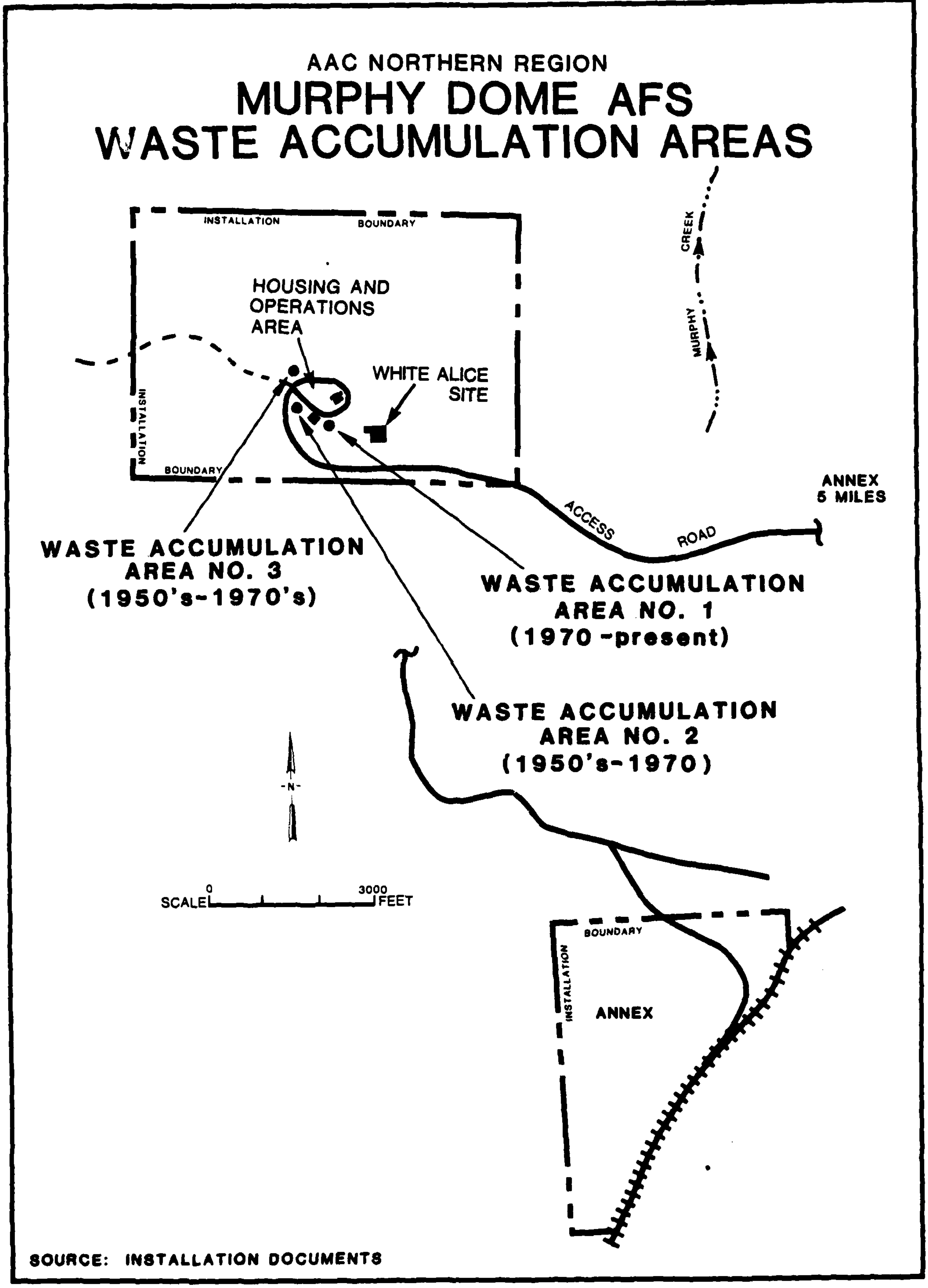
Tin City AFS

One active waste accumulation area has been used at Tin City AFS as shown in Figure 4.8. This area is located between Buildings 110 and 119. The area also serves as the base supply storage area for drummed materials such as oil and ethylene glycol. There is evidence of small spills and leaks in this area. No major spills in this area have been reported.

Fuels Management

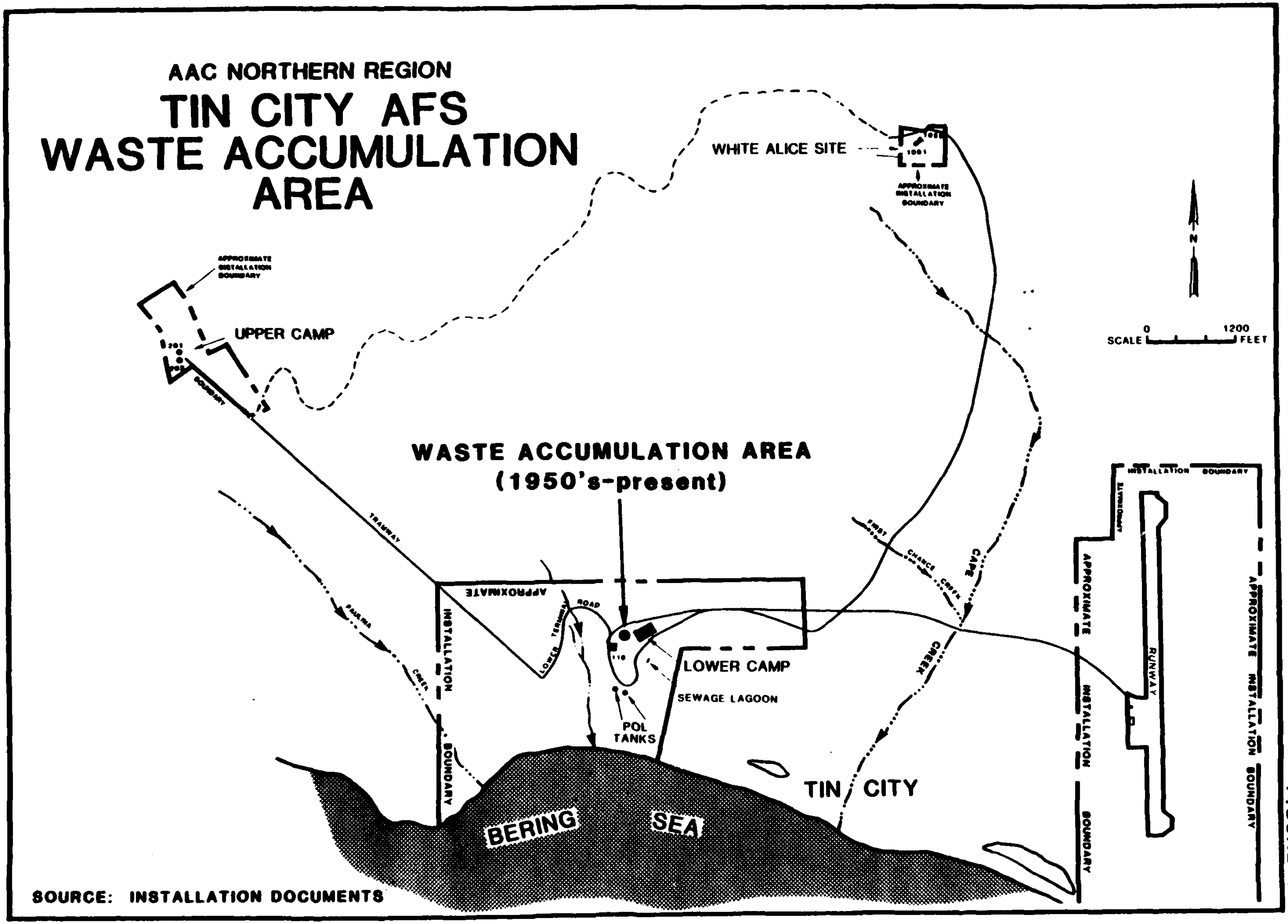
The liquid fuels systems for the AAC Northern installations consist of above, partially buried and below ground storage tanks. Fuels stored include diesel fuel, MOGAS, AVGAS and JP-4. A summary listing of liquid fuel storage tanks at the various installations is presented in Appendix

FIGURE 4.7



ES ENGINEERING-SCIENCE

FIGURE 4.8


AAC NORTHERN REGION
TIN CITY AFS
WASTE ACCUMULATION
AREA
WHITE ALICE SITE
APPROXIMATE INSTALLATION BOUNDARY
UPPER CAMP
N
SCALE 0 1200 FEET
WASTE ACCUMULATION AREA
(1950's-present)
TRAMWAY
APPROXIMATE
INSTALLATION
BOUNDARY
LOWER TERMINAL ROAD
LOWER CAMP
SEWAGE LAGOON
POL
TANKS
CAPE
CREEK
FIRST CHANCE CREEK
TIN CITY
BERING
SEA
RUNWAY
SOURCE: INSTALLATION DOCUMENTS

D. Following is a discussion of the fuels system at each AAC installation. Spills and leaks from these facilities are discussed in a subsequent subsection.

Galena AFS

Above ground and below ground tanks are used at Galena AFS for storing liquid fuels (JP-4, AVGAS, MOGAS, and diesel fuel). Fuels are shipped by barge to the site. A pipeline is used to transfer most POL to the bulk storage tanks located on the USAF property at Galena Airport. Some fuels are trucked from the barge to tanks. Inventory controls are used to detect leaks from tanks and pipelines. The main transfer pipeline is pressure tested each year prior to arrival of the supply barge.

The large bulk storage tanks (25,000 gallons and greater) which contain aircraft fuel are cleaned at an approximate frequency of every three years. Other tanks are not cleaned unless the fuel shows poor quality. Sludge from POL tanks (typically 10 to 15 gallons per tank) has been drummed for off-base disposal through DPDO during the last few years. In previous years it is presumed the sludge has been weathered on the ground within the bermed tank areas.

Periodically water needs to be drained from the POL tanks. The water-fuel mixture from the very large Tank Nos. 37 and 38 is taken to a waste fuel tank (Facility 1572) but at other tanks (Tanks 1 through 16 and 25 through 33 located at the Tank Farm) it is drained to the ground.

Campion AFS

Liquid fuels for Campion AFS were delivered by barge to a landing site about 1.25 miles northeast of the housing and operations area. Fuels were then pumped through a pipeline to the station bulk storage tanks, prior to subsequent distribution to smaller tanks near the point of use. An area near the barge landing site was also used to store drummed POL and other chemical products prior to transporting them to the camp by truck. Inventory control was used as a means of assessing leaks within the POL system except the pipeline which was pressure tested before each annual use. No POL tanks were cleaned at Campion. Some sludge currently exists in the bulk storage tanks.

Cape Lisburne AFS

The liquid fuel storage tanks at Cape Lisburne AFS are either above ground or partially buried. Bulk fuel is delivered by barge to Cape Lisburne once per year during the summer. Diesel fuel is transferred from the barge to the bulk storage tanks using the barge pump. MOGAS is transferred from the barge to a bulk storage tank using a tank truck. The fuel lines are pressure tested annually for leaks. Inventory controls are used for assessment of leaks from tanks. According to current installation personnel, the tanks have not been cleaned. Lack of POL sludge removal has been typical at all the LRR sites since high quality arctic diesel fuel has been used and aircraft fuel (which requires stringent quality control) has not been stored.

Fort Yukon AFS

Liquid fuel storage at Fort Yukon AFS consists of above and below ground MOGAS and diesel tanks. Fuel is delivered to the installation by barge on the Yukon River. The barge landing is located near the community of Fort Yukon and the fuel is transferred from the barge to bulk storage tanks using tanker trucks. Fuel lines at the installation are all above ground except at road crossings. The lines are pressure tested annually to determine whether or not leaks are present. Inventory controls are used for assessment of leaks from tanks. According to installation personnel, the tanks have not been cleaned.

Indian Mountain AFS

All fuel supplies for Indian Mountain AFS are airlifted to the site. Currently, liquid fuel is pumped from the aircraft to bulk POL tanks along the runway. The fuel feeds the Lower Camp by gravity through a pipeline. Trucks transport fuel from the Lower Camp to the Upper Camp bulk tanks. Leaks from the liquid fuel tanks are monitored by inventory control. As discussed later, the Indian Mountain AFS fuel system has had considerable leak and spill problems. The fuel tanks have not been cleaned.

Kotzebue AFS

The liquid fuel storage tanks at Kotzebue AFS consist of above ground and partially buried diesel fuel and MOGAS tanks. Fuel is delivered to the installation by tanker truck. Fuel was formerly delivered to the installation by barge. Prior to the partial deactivation of the

installation in 1985, the heaters were turned on in buildings to burn off fuel in the storage tanks. The only active tanks at the installation are a diesel fuel storage tank which serves as the supply for an emergency generator and two MOGAS tanks that are used to service installation vehicles. Tanks at the installation have not been cleaned.

Murphy Dome AFS

Murphy Dome AFS receives fuel by tank truck. The fuel is unloaded to the bulk POL tanks and a few other smaller tanks. Fuel is transferred from the bulk tanks to other intermediate storage tanks prior to usage. Inventory controls are used for monitoring the system for major leaks. Tanks at the installation have not been cleaned.

Tin City AFS

There are above and below ground liquid fuel storage tanks at Tin City AFS that are used for storage of diesel fuel and MOGAS. Fuel is delivered to the installation once per year by barge. Both diesel fuel and MOGAS are pumped from the barge to a beach pump house and then to the bulk storage tanks. The fuel lines are pressure tested annually for leaks. Inventory controls are used for assessment of leaks from tanks. According to installation personnel, the tanks have not been cleaned.

Spills and Leaks

Current and former employees were interviewed and installation files were reviewed to determine the installation history concerning spills and leaks from fuel storage systems, waste accumulation areas and facility material and waste handling operations. Documentation on spills and leaks was only available back to the mid-1970's; it is probable other events similar to these discussed occurred in the 1950's and 1960's.

Galena AFS

As previously discussed, there has been considerable routine spillage and leakage of wastes at the power plant accumulation area. Also, the POL Tank Farm has received fuel/water drainage and POL sludge. Another major drum storage area, used until the 1960's, particularly before construction of the POL bulk storage tanks, was located in an

unpaved area between the runway and apron (see Spill/Leak No. 1 area in Figure 4.9). This area is currently off Air Force property. The area stored a large number of drums containing unused AVGAS, JP-4, JP-1, diesel fuel, solvents, thinners, cooking fuel and possibly some waste products. Drums were stacked horizontally about three drums high and ten drums wide. Most of the drums reportedly were drained out during use but residuals of 3 to 5 gallons remained in each. These residuals were regularly dumped on the ground prior to shipping the empty barrels off the installation. Thus, this Spill/Leak No. 1 area has had extensive materials discharged to the ground. In the 1940's some major flooding on the installation washed drums stored at this location over the entire Galena area. Many of these empty drums are in use by local residents, are lying along roadsides, or are crushed and stacked in large piles off the installation (Appendix F shows a photograph of one such pile of old drums).

In the mid-1950's the underground fuel transfer line from the barge unloading area leaked (Spill/Leak No. 2) to the ground in the vicinity of Facility 1403 (Figure 4.9). An estimated 20,000 to 30,000 gallons of diesel fuel was lost to the ground. This leak occurred on or adjacent to presently occupied Air Force land.

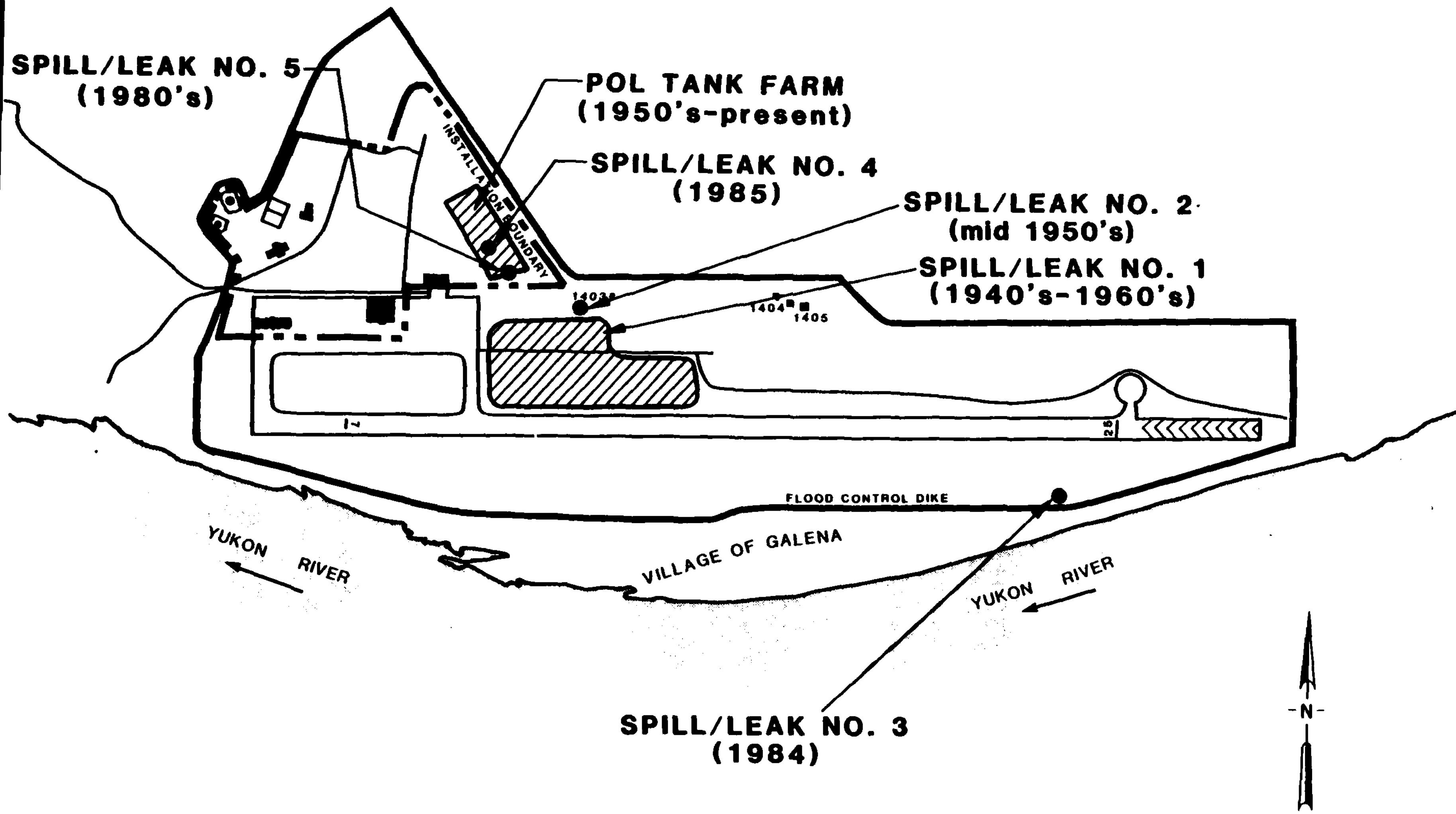
Another spill (No. 3) occurred in 1984 when a POL tank truck accident resulted in a loss of approximately 4,000 gallons of JP-4 fuel. The vehicle had loaded fuel at the barge area and went off the dike near this location which is not on Air Force property (Figure 4.9). Absorbents were used to collect much of the fuel. Soil soaked with fuel was excavated to the permafrost and taken to the off-base landfill along with the absorbent material.

In 1985 a grader hit a MOGAS fill stand (near Tanks 1 through 8). An estimated 200 to 500 gallons spilled and none was recovered. This Spill/Leak No. 4 is shown in Figure 4.9.

Valve Pit No. 2, located near the MOGAS fill stand (Spill/Leak No. 4) is also reported to be an area with periodic small equipment leaks. This pit (Spill/Leak No. 5) is located where a number of POL pipelines join (Figure 4.9).

FIGURE 4.9

AAC NORTHERN REGION
GALENA AFS
SPILLS AND LEAKS



SOURCE: INSTALLATION DOCUMENTS

Campion AFS

As noted earlier, spillage of waste materials has occurred at Waste Accumulation Area Nos. 1 and 2. Some interviewees noted that there has been several spills and leaks in the bulk storage tank area (Spill/Leak No. 1). Evidence of POL seepage outside the dike near the channels which drain east was indicated (Figure 4.10). It was also noted that spills and leaks occurred at the storage area for unused product located near the barge landing (Spill/Leak No. 2). No other major spills and leaks were identified at Campion AFS.

Cape Lisburne AFS

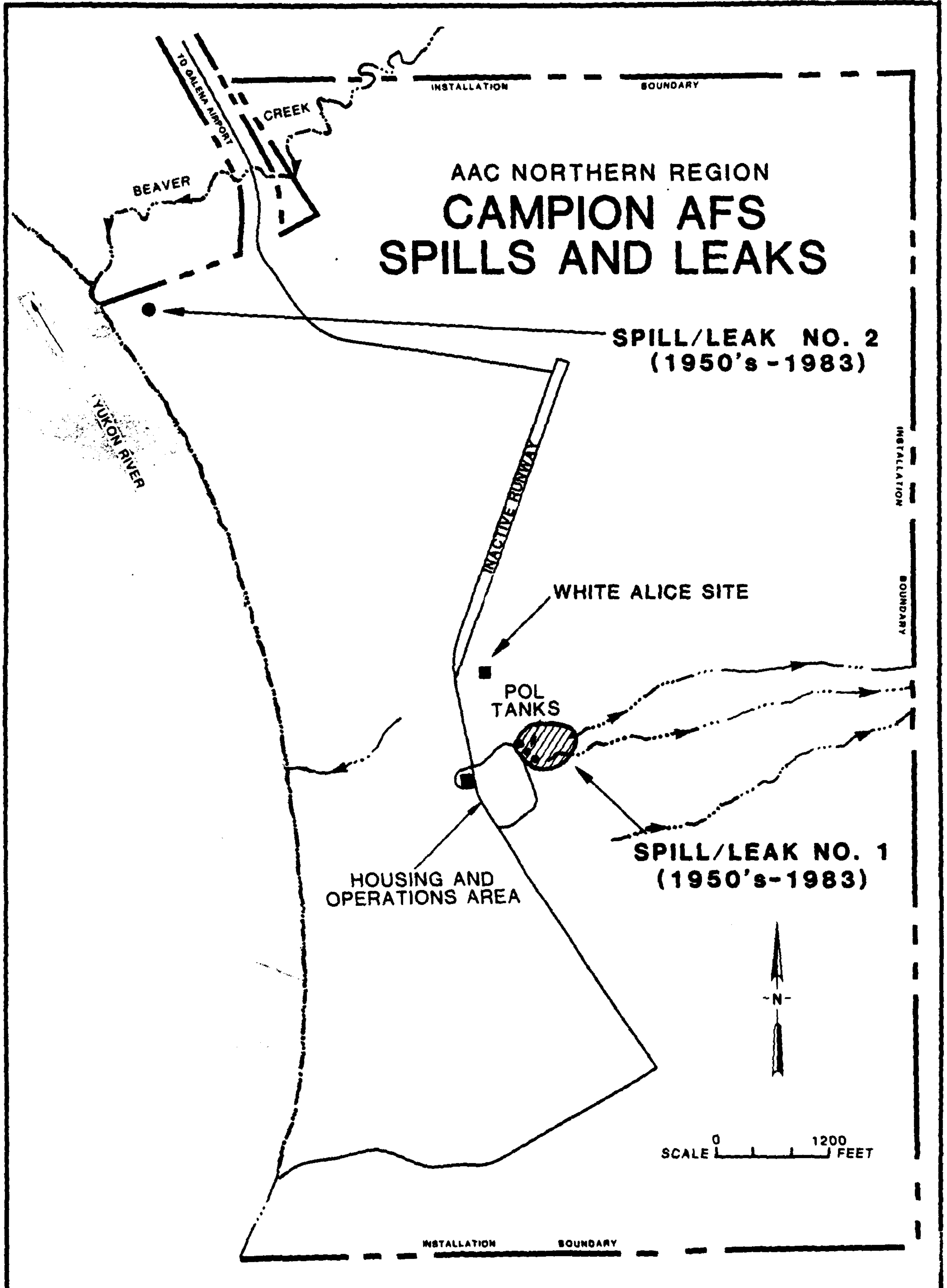
Two significant fuel spills have occurred at Cape Lisburne AFS at locations shown in Figure 4.11. One of the fuel spills (Spill/Leak No. 1) occurred in 1980. The diesel fuel storage tank adjacent to the power plant was overfilled, resulting in the spillage of 3,000 gallons of diesel fuel onto the ground. Information contained in the Spill Prevention, Control and Countermeasures Plan for the Installation (Environmental Systems Corporation, 1981) indicates that no fuel was recovered. After the fuel spill, the tank has been partially buried and a high level alarm has been installed. There was no visual evidence of the spill at the time of the site visit for the Phase I IRP study.

A second fuel spill (Spill/Leak No. 2) occurred in 1982. This spill occurred when a fuel bladder containing AVGAS owned by the National Oceanographic and Atmospheric Administration (NOAA) ruptured. The bladder was located in the apron area of the runway, north of the terminal structure. Approximately 1,500 gallons spilled onto the gravel apron. No clean up of the spill was performed. After the spill, fuel was stored in drums until 1984 when a double bottom tank was brought onto the installation.

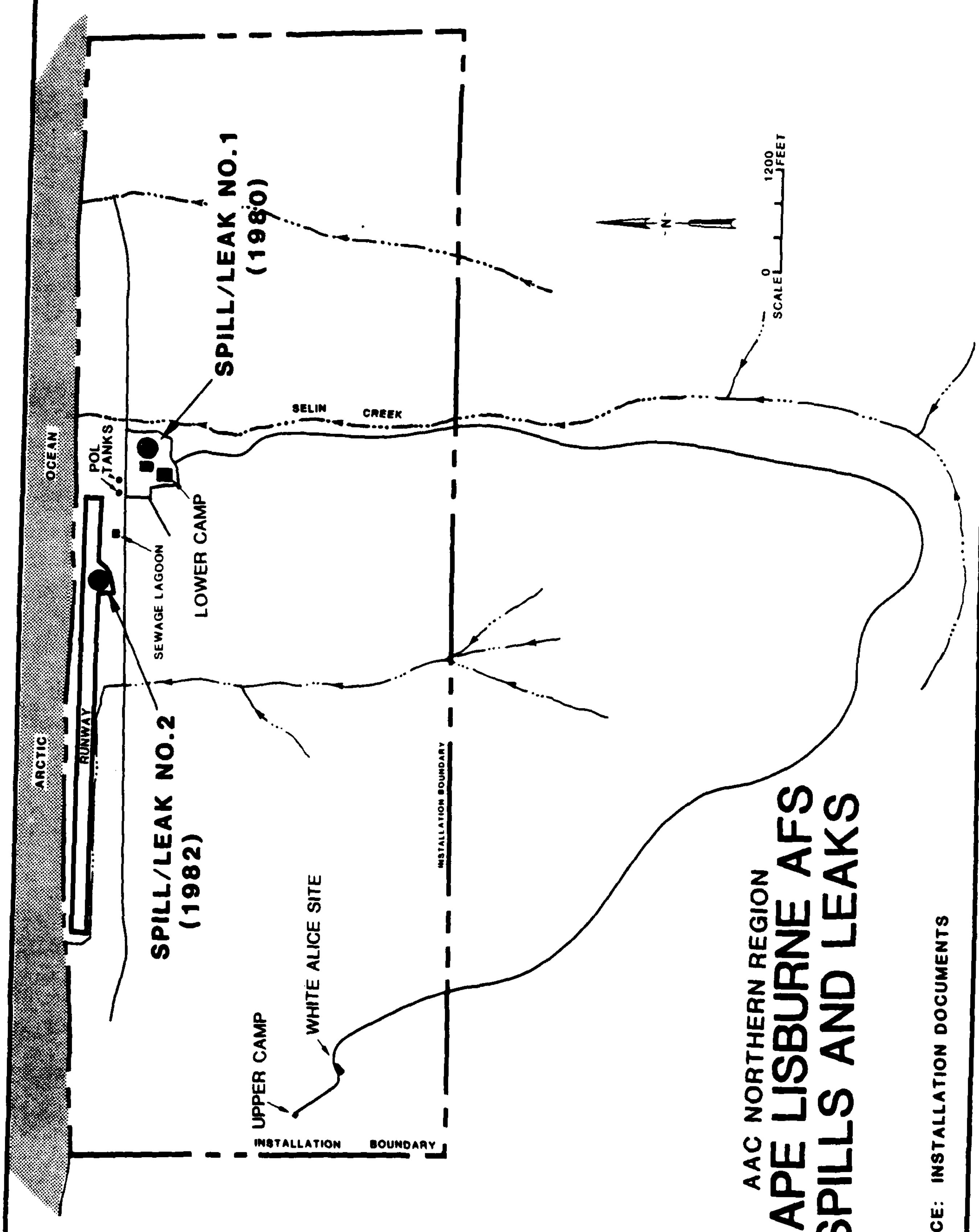
Fort Yukon AFS

Two diesel fuel spills of 100 gallons and less are reported in the installation's Spill Prevention, Control and Countermeasures Plan (Environmental Systems Corporation, 1981). No major fuel spills are documented in this plan and no major fuel spills were recalled by installation personnel. Discharge of diesel fuel and waste oil has occurred beneath the old power plant in Building 103 (Figure 4.12). The floor drains in the power plant drain to the ground beneath the building.

FIGURE 4.10



SOURCE: INSTALLATION DOCUMENTS

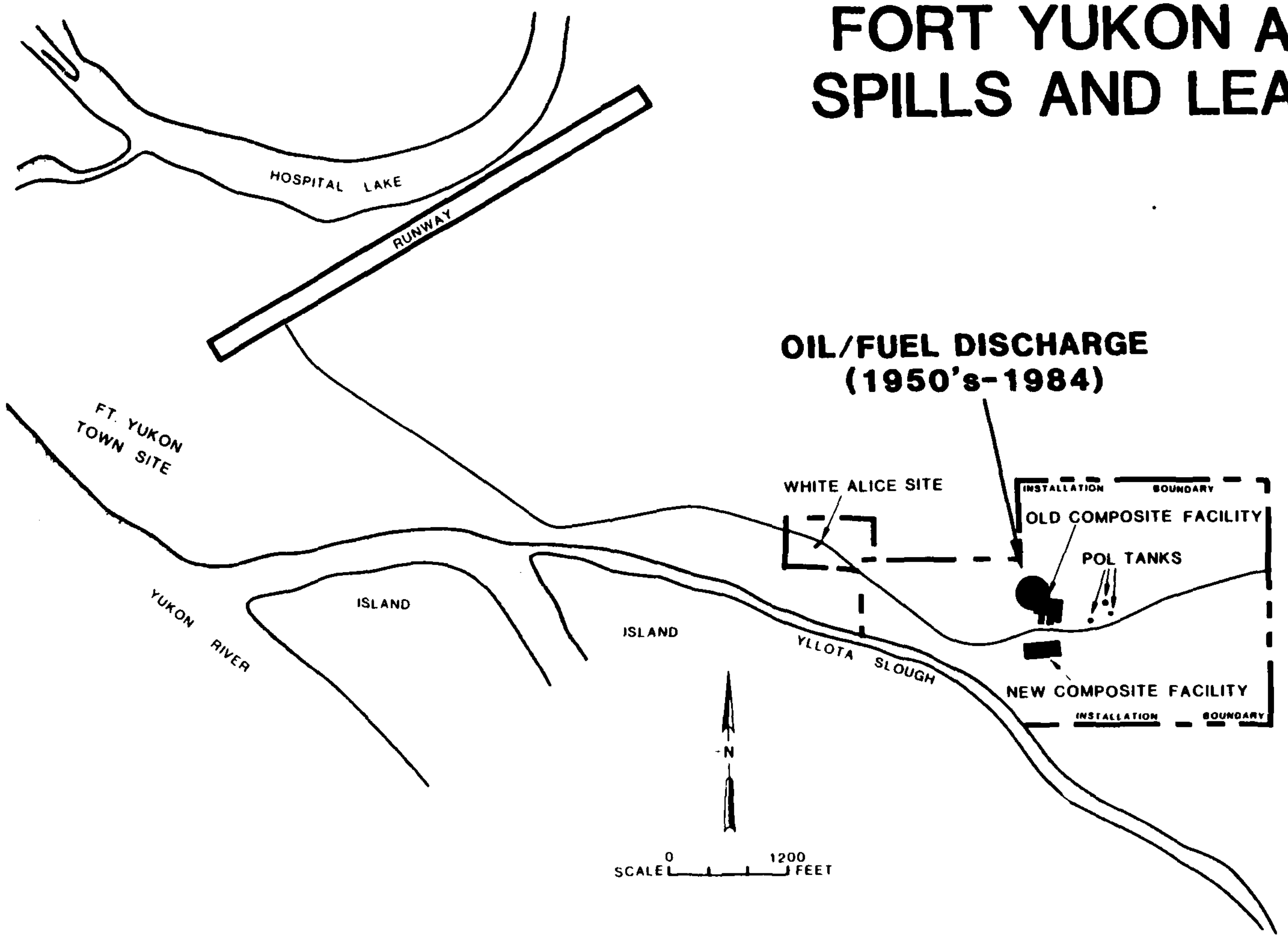


AAC NORTHERN REGION
CAPE LISBURNE AFS SPILLS AND LEAKS

SOURCE: INSTALLATION DOCUMENTS

AAC NORTHERN REGION

FORT YUKON AFS SPILLS AND LEAKS



SOURCE: INSTALLATION DOCUMENTS

Oily soils were seen on the ground beneath the building during the Phase I site visit.

Indian Mountain AFS

Numerous diesel fuel spills have occurred at Indian Mountain during its operating history. Table 4.2 summarizes the major recent spills and leaks reported and Figure 4.13 shows these locations. There have also been a number of smaller liquid fuel spills and leaks in the 100 to 500 gallon range at both Upper and Lower Camps. A waste accumulation area containing a stack of approximately 350 barrels labeled diesel fuel and MOGAS was a suspected source of leakage at the Upper Camp in 1978. The waste oil storage tank at the power plant has overflowed and lines leading to it have leaked on several occasions (Spill/Leak No. 11). Several reports from the 1970's note observations of a fuel/water mixture seeping from the ground at the Upper Camp. Collection pits and absorbents were used as much as possible to recover the fuel from these seepage areas. The fuel spills and leaks at the installation are documented only back to the mid 1970's; however, it is probable that the events noted in Table 4.2 (except the very large 1977 loss) are indicative of similar losses in the 1950's and 1960's.

Kotzebue AFS

Three significant fuel spills or leaks have occurred at Kotzebue AFS. A diesel fuel leak (Spill/Leak No. 1) occurred in a fuel pipeline in the mid-1970's (Figure 4.14). A coupling near the officer's wing of Building 103 (northernmost wing) failed resulting in a release of fuel to the ground. A fuel spill (Spill/Leak No. 2) occurred in 1979-1980 when the day tank behind the power plant was overfilled. After each of these spills absorbent material was used to clean up the fuel that remained on the surface of the ground.

In 1984, a fuel leak (Spill/Leak No. 3) was observed during an Alaska Department of Environmental Conservation (DEC) site inspection. Through a subsequent investigation conducted by the Air Force at the request of DEC, it was determined that the leak was occurring through a hole in the fuel line between a 50,000-gallon tank and the steam boiler day tank. The fuel line was repaired and fuel oil collection trenches were excavated using a bulldozer. Approximately 4,000 gallons of diesel fuel were collected by pumping from the recovery trenches. Absorbent

TABLE 4.2
MAJOR SPILLS AND LEAKS AT INDIAN MOUNTAIN AFS

Year	Site No.	Quantity Diesel Fuel Spilled/ Leaked	Spill/Leak Type and Location	Result
1973	1	29,000	Bladder rupture - bulk storage area - Lower Camp	Recovered about 80%.
1973	2	3,500	Fuel line rupture - gym & radar operations - Upper Camp	Fuel soaked into ground.
1974	3	33,000	Bladder leak - bulk storage area - Lower Camp	Contained in dike area; recovered 80-90%.
1976	4	4,000	Tank overflow - Building 110 - Lower Camp	Contained in dike area; recovered 80-90%.
1977-78	5	Unknown	Line leaks between bulk tanks and tanks - Upper Camp	Probable several thousand gallon leaks to ground.
1977	6	3,000	Fuel line leak - Building 207 - Upper Camp	Fuel soaked into ground.
1977	7	46,500	Drain valve of bulk tank open - Upper Camp	Fuel soaked into ground and periodically flowed on surface; some fuel burned on ground to minimize infiltration and runoff.
1977	8	3,500	Tank overflow - bulk tank area - Lower Camp	Absorbents applied but most soaked into ground; absorbents and some soil removed and put in landfill.
1979	9	1,500	Fuel line leak - Building 221 - Upper Camp	Fuel likely soaked into ground.
1979	10	7,800	Fuel line leak - between bulk tanks and Building 217 - Upper Camp	Fuel soaked into ground.

Source: Installation documents.

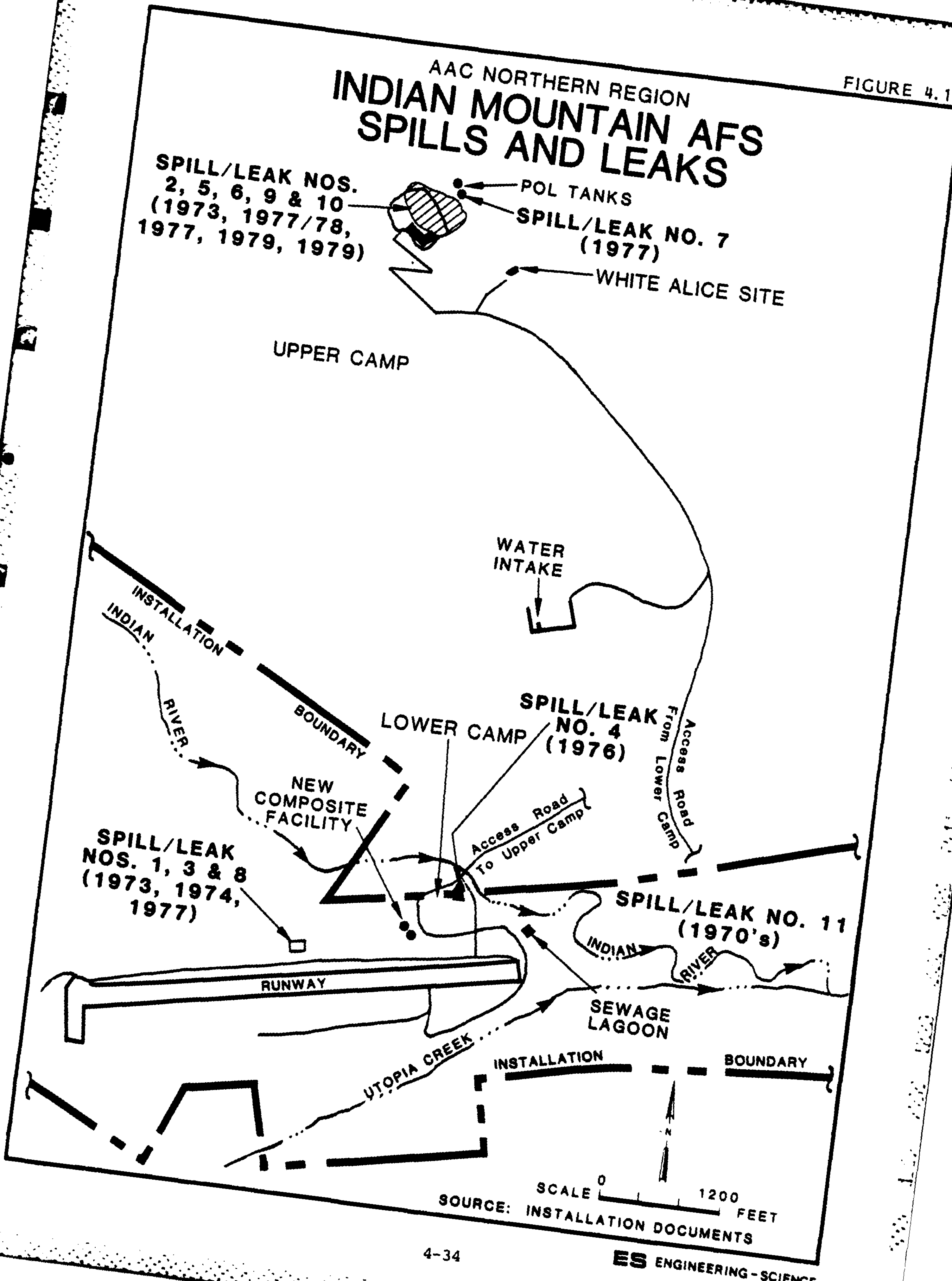
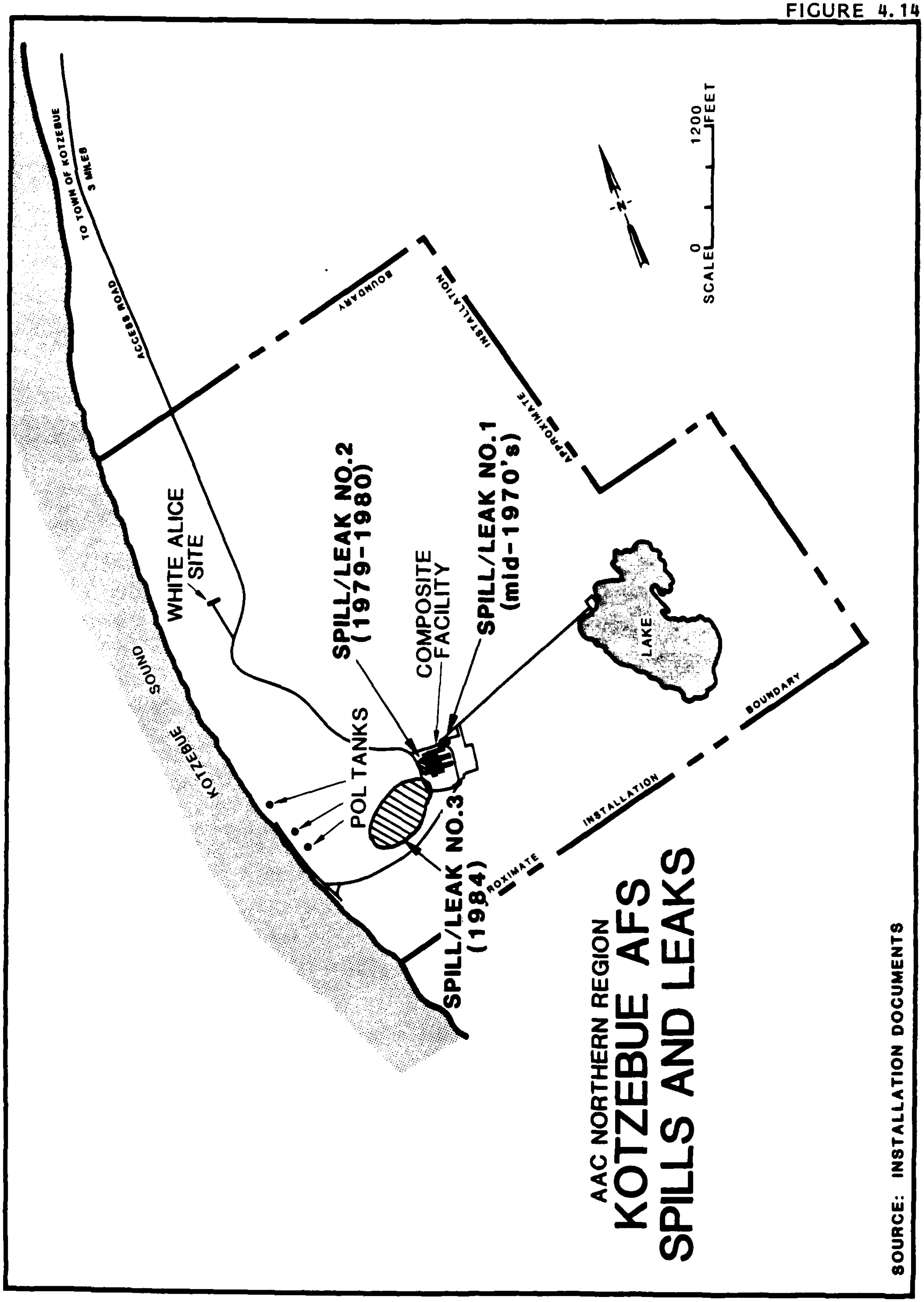

AAC NORTHERN REGION
INDIAN MOUNTAIN AFS
SPILLS AND LEAKS
FIGURE 4.13
SPILL/LEAK NOS. 2, 5, 6, 9 & 10 (1973, 1977/78, 1977, 1979, 1979)
POL TANKS
SPILL/LEAK NO. 7 (1977)
WHITE ALICE SITE
UPPER CAMP
WATER INTAKE
INSTALLATION BOUNDARY
INDIAN RIVER
SPILL/LEAK NO. 4 (1976)
LOWER CAMP
Access Road From Lower Camp
NEW COMPOSITE FACILITY
Access Road To Upper Camp
SPILL/LEAK NOS. 1, 3 & 8 (1973, 1974, 1977)
SPILL/LEAK NO. 11 (1970's)
INDIAN RIVER
RUNWAY
SEWAGE LAGOON
UTOPIA CREEK
INSTALLATION BOUNDARY
N
SCALE 0 1200 FEET
SOURCE: INSTALLATION DOCUMENTS

FIGURE 4.14



AAC NORTHERN REGION
KOTZEBUE AFS SPILLS AND LEAKS

SOURCE: INSTALLATION DOCUMENTS

material was also used to remove oil from the surface of the trenches. The seepage of fuel into the trenches has slowed and pumping has been discontinued. Additional test pits were dug to determine the extent of the fuel oil contamination. Collection trenches were lined with plastic on the side toward the beach in an attempt to prevent migration of fuel to the beach.

During the site visit for this Phase I IRP study the soil in the area behind the power plant was stained with diesel fuel. Fuel was observed at the surfaces of the trenches and in a small stream that flows behind the power plant. Areas of vegetative stress between the installation facilities and the beach were observed. The odor of diesel fuel was present in the area.

Murphy Dome AFS

Two major fuel spill incidents are reported at Murphy Dome since the 1970's. One spill of approximately 2,500 gallons occurred (1970 to 1974) when a tank overflowed. The tank involved is not identified in available records but for the size of loss it is presumed to be at the bulk storage area. In 1981 another overflow occurred at the bulk storage area with an estimated loss of 7,500 gallons. The spill was contained in the bermed area (Figure 4.15) and approximately 6,800 gallons were recovered. Some of the soil within the diked area (approximately one foot deep) was removed and disposed off base.

Tin City AFS

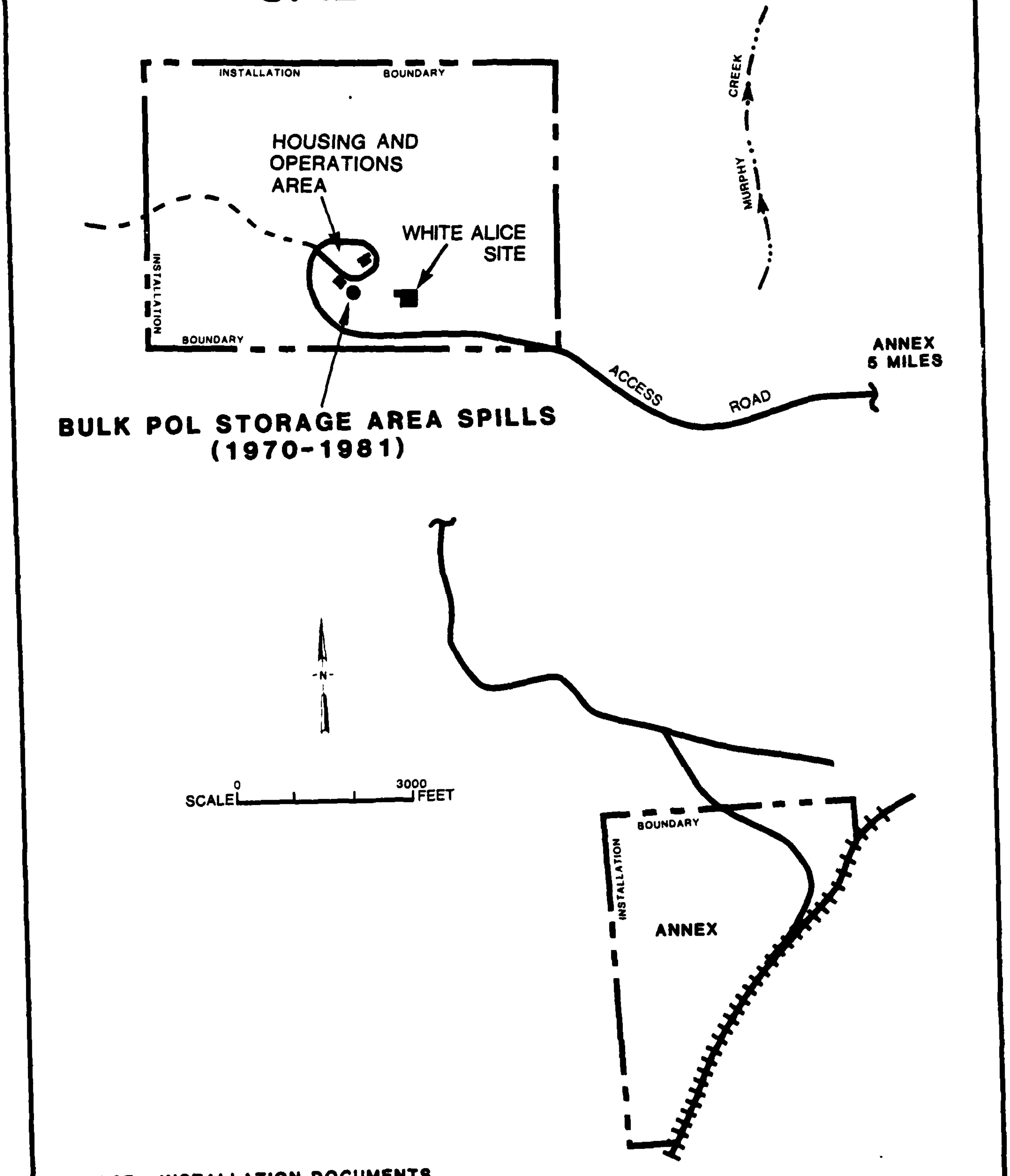
The Spill Prevention, Control and Countermeasures Plan for this installation (Environmental Systems Corporation, 1981) indicates that two fuel spills occurred (Figure 4.16). One of these spills (Spill/Leak No. 1) consisted of 850 gallons of diesel fuel caused by a valve failure at the White Alice site. This spill occurred in 1980. The other spill (Spill/Leak No. 2) consisted of 300 gallons of diesel fuel that leaked from a pipeline that broke because of the weight of ice and snow on the line near the tank at the incinerator. This spill occurred in 1979. Installation personnel were not aware of the occurrence of any other fuel spills or leaks at Tin City AFS.

Pesticide Utilization

Pesticides have not been used in significant quantities at the installations included in this study. Pesticide usage has been limited

FIGURE 4.15

AAC NORTHERN REGION
MURPHY DOME AFS SPILLS AND LEAKS



SOURCE: INSTALLATION DOCUMENTS

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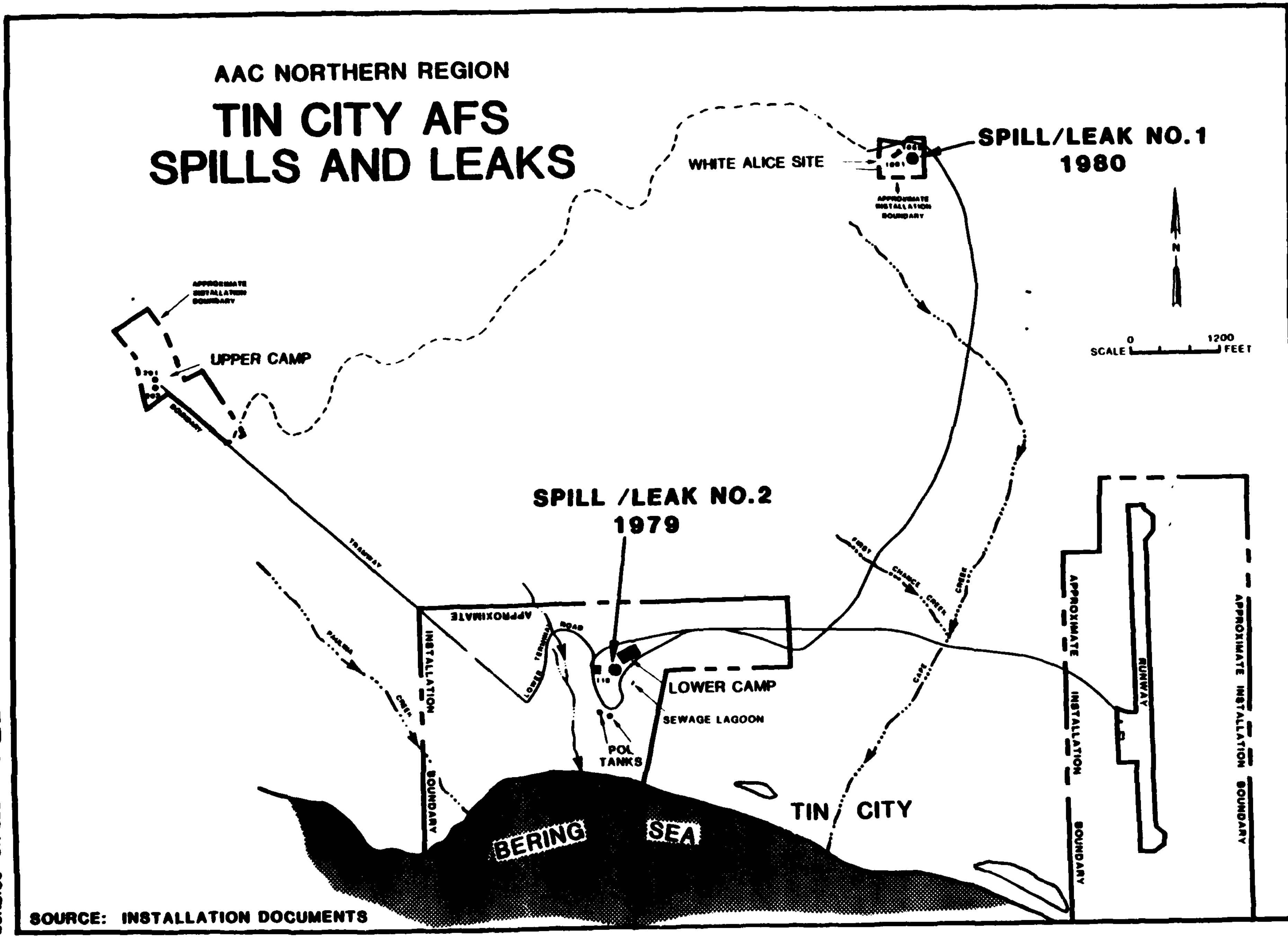
FIGURE 4.16


AAC NORTHERN REGION
TIN CITY AFS
SPILLS AND LEAKS
SPILL/LEAK NO.1
1980
WHITE ALICE SITE
APPROXIMATE INSTALLATION BOUNDARY
UPPER CAMP
SCALE
0
1200
FEET
N
SPILL /LEAK NO.2
1979
TRAMWAY
LOWER CAMP
SEWAGE LAGOON
POL
TANKS
LOWER TERMINAL ROAD
APPROXIMATE INSTALLATION BOUNDARY
FIRST CHANCE CREEK
CAPE CREEK
RUNWAY
TIN CITY
BERING SEA
SOURCE: INSTALLATION DOCUMENTS

to occasional spraying of malathion to control mosquitos and/or spraying to control insects inside of buildings. There has been no usage of pesticides at these installations that would indicate a potential for contamination because of pesticide handling.

Fire Protection Training

Campion AFS, Kotzebue AFS Murphy Dome AFS and Tin City AFS

No fire protection training areas were identified at Campion, Kotzebue, Murphy Dome and Tin City installations.

Galena AFS

Fire training activities have taken place at Galena AFS since the late 1950's. Figure 4.17 shows the location of the fire protection training area (FPTA) in the northeast corner of the airport. The training area is a shallow soil combustion pit with an aircraft mockup. Currently, the FPTA is used approximately once per week from June to November. In the wetter months of April and May the training session frequency drops to once per month. The facility is not used December to March.

Approximately 300 to 500 gallons of fuel are used per fire, and two fires per training session has been typical. When the surface soils are not frozen, the combustion pit is prewetted with water before pouring fuel on the surface. No water is applied when the ground is frozen. Fuels presently used are clean and contaminated JP-4. In the 1950's and 1960's some combustible shop wastes such as AVGAS, thinners, paints, oils, etc., were used. Fire extinguishing agents used at the site have included protein foam, chlorobromethane, dry chemicals, halon and aqueous film forming foam (AFFF).

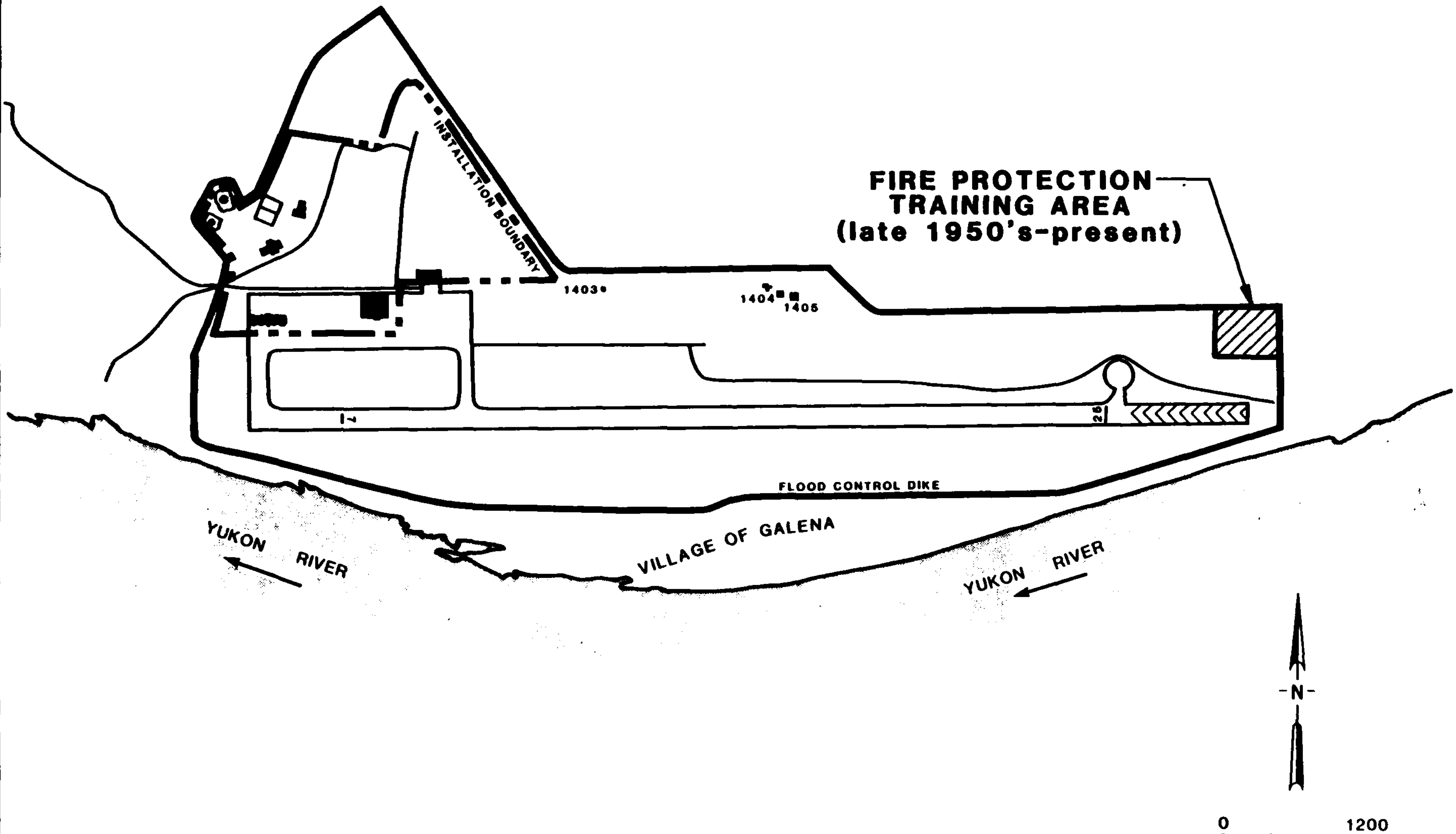
Cape Lisburne AFS

Installation documents dated 1975 indicate that waste oil and spent solvents from the vehicle maintenance shop were collected in 55-gallon drums for disposal through the Fire Department for fire protection training exercises. However, no installation personnel could identify the location used for fire training exercises. Training activities at other LRR installations have been minimal to none, so it is probable that this site had little usage.

FIGURE 4.17

AAC NORTHERN REGION

GALENA AFS
FIRE PROTECTION TRAINING AREA



SOURCE: INSTALLATION DOCUMENTS

Fort Yukon AFS

A fire protection training area was used at Fort Yukon AFS from the early 1970's to approximately 1978. The training area was a shallow circular pit, located on sand, adjacent to a slab of concrete, west of Buildings 111 and 113. The area was used for training in fighting structural fires. Small quantities of waste fuel, waste oil and spent solvent were burned during training exercises. The pit has been filled in with sand, since the time during which it was used as a fire protection training area. Except for a blackened pipe on the concrete slab adjacent to the training area, there is no evidence that the area was used for fire fighting training.

Indian Mountain AFS

One installation document notes a fire training pit at Indian Mountain AFS. No interviewees could verify the fire training activity or the burning location. It is probable fire training was small and infrequent like other LRR installations.

INSTALLATION WASTE DISPOSAL METHODS

A review was made of the methods used to dispose of hazardous wastes at the AAC Northern installations. Information was obtained from installation files, interviews with installation employees, and site inspections. Waste disposal sites in the vicinity of but beyond the present installation property were included in this study if the operations were entirely by the Air Force. Joint disposal operations with another entity were excluded.

The facilities and methods used for disposal of hazardous wastes at the installations include some or all of the following:

- Landfills
- Dumps
- Hardfills
- Ground Application
- Explosive Ordnance Disposal
- Incinerators
- Sanitary Sewerage Systems
- Surface Drainage Systems
- Miscellaneous Disposal Methods

Appendix F presents photographs of several disposal areas discussed. Figures in this section showing landfills and dumps are for location purposes only; the size (acreage) of the sites is not well defined.

Landfills

Galena AFS

Since the beginning of Air Force activities at Galena Airport in the 1940's solid waste disposal has taken place at a landfill site west of the diked area around the airport. This landfill is not on Air Force property but the facility has been jointly operated by the USAF and the community of Galena.

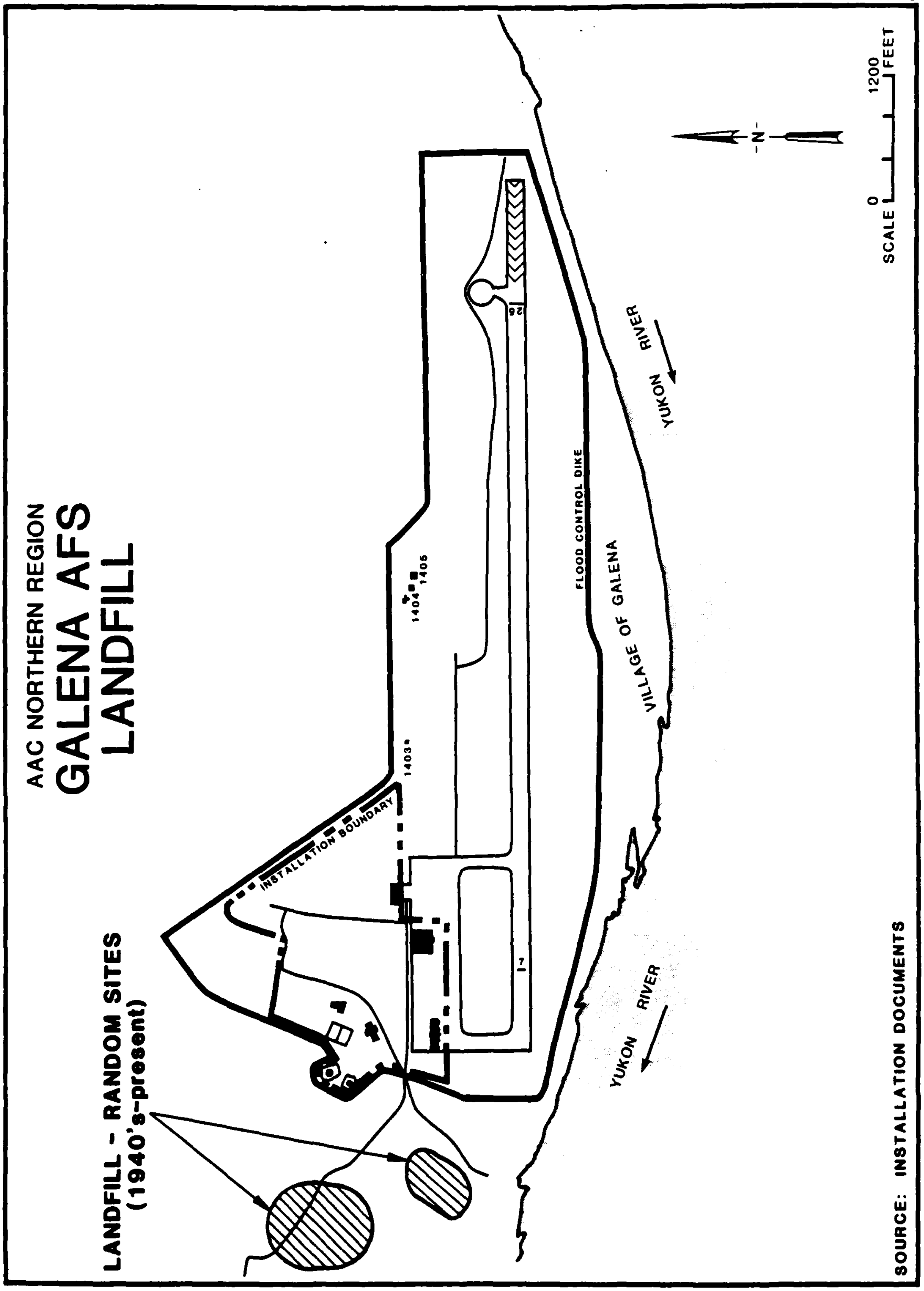
Wastes disposed at the site by the Air Force have included garbage, refuse, incinerator ash (since 1975), wood, metal, plastic and bulky materials such as construction and demolition debris. Some shop wastes such as ethylene glycol, paint residues, oil filters, rags with solvents, batteries, etc., have been taken to the site also. Empty drums from base activities in the 1960's and 1970's were buried in the vicinity of the landfill. Burning has been done at the site during its entire operation history. Typically the landfilling has been in shallow trenches (down to permafrost) but some area filling has taken place. The landfill has been spread over a relatively large area as shown in Figure 4.18. Flooding of the Yukon River has moved materials around on the site area at times.

Campion AFS

Three landfills have been operated at Campion AFS. The initial site (Landfill No. 1) operated 1.5 miles south of the camp on both sides of the local road (Figure 4.19). This area has several burial sites, on the southeast and northwest sides of the road as well as in an area further southwest along the road. Garbage, refuse, wood, metal, plastic, construction and demolition debris, and some shop wastes went to this landfill. This area was operated for camp wastes until the mid-1970's when the Alascom facilities were installed near the site.

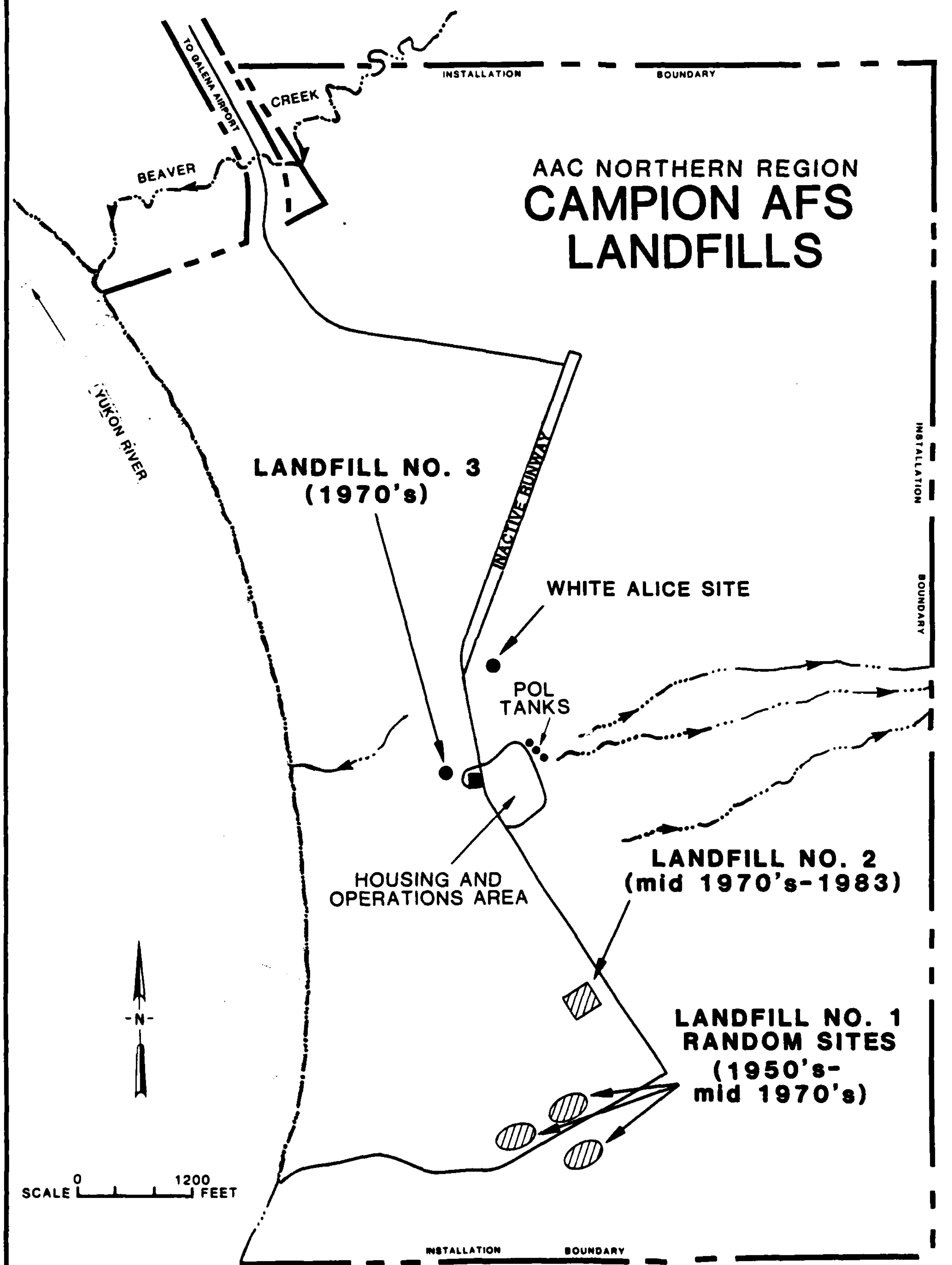
Landfill operations then moved to another area about 0.5 mile along the road which goes southeast out of the camp. Landfill No. 2 is shown in Figure 4.19. This landfill operated until 1983 when the station was

FIGURE 4.18



SOURCE: INSTALLATION DOCUMENTS

FIGURE 4.19



SOURCE: INSTALLATION DOCUMENTS

deactivated. A trench operation was used for burying the wastes (similar to those for Landfill No. 1).

Another area used to dispose of solid wastes (Landfill No. 3) was located near the CE area (Building 120) and the camp baseball diamond. The area just west was used to bury scrap metal, empty drums, wood, old equipment and other bulky items. Some small amounts of refuse may have been included due to its convenient location. This area was used in the 1970's.

<u>Cape Lisburne AFS</u>

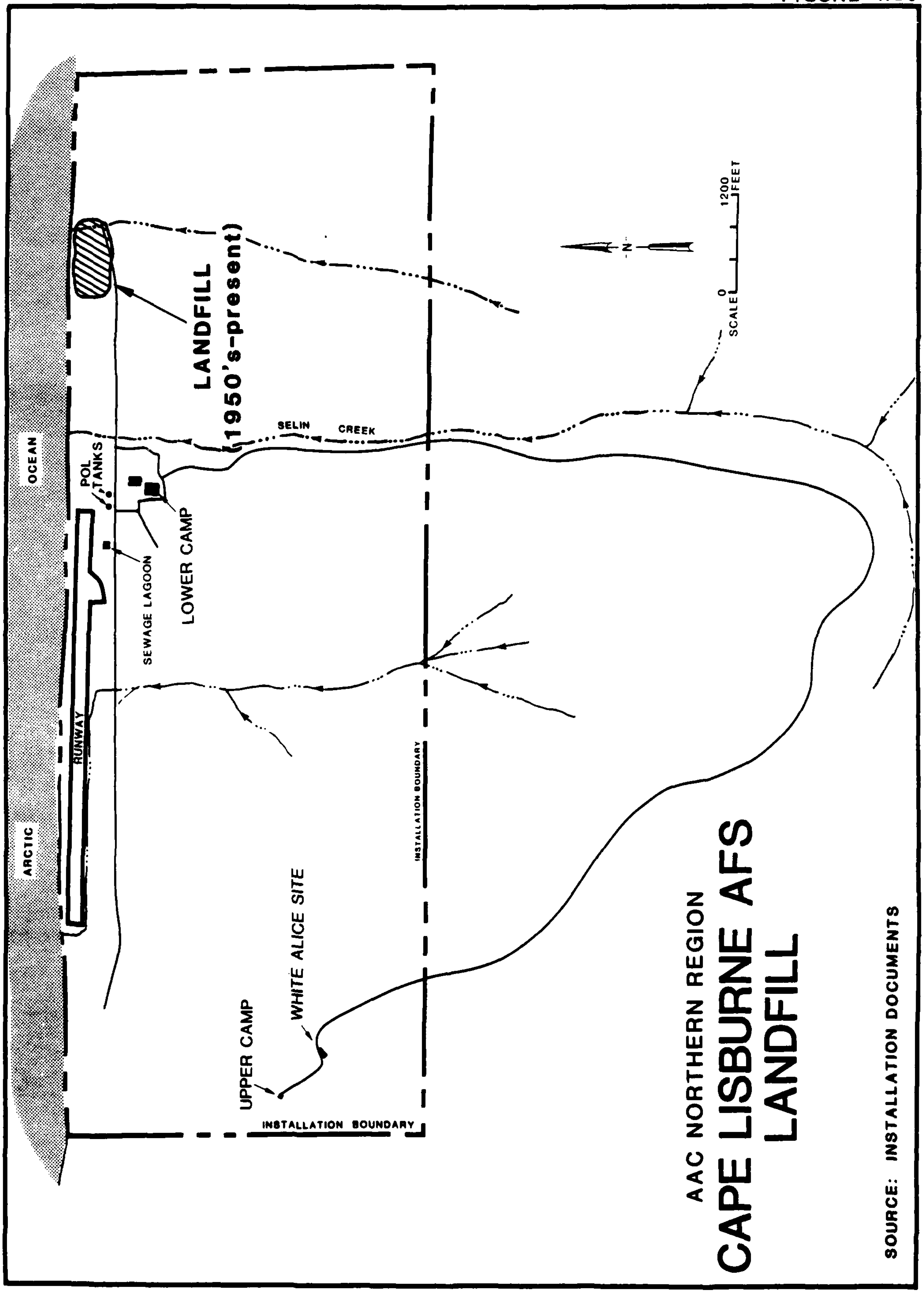
There is one active landfill at Cape Lisburne AFS (Figure 4.20) that has probably been used since the installation was activated. The installation landfill is located in a ravine east of the Lower Camp. The landfill is operated by placing the waste on the ground and burning it. Open burning of solid wastes has been practiced at the installation since the incinerator was taken out of service in 1983. The refuse is bulldozed into the ravine and covered with crushed rock twice per year.

Shop wastes that are routinely disposed of in the landfill include batteries, paints, scrap metal and oily rags. Although petroleum based wastes and materials are not routinely disposed of in the landfill, leaking oil drums that have been damaged during the winter or during spring thaw have been taken to the site. Also, spent trichloroethylene from the annual overhaul at the power plant has been burned with other wastes at the landfill.

<u>Fort Yukon AFS</u>

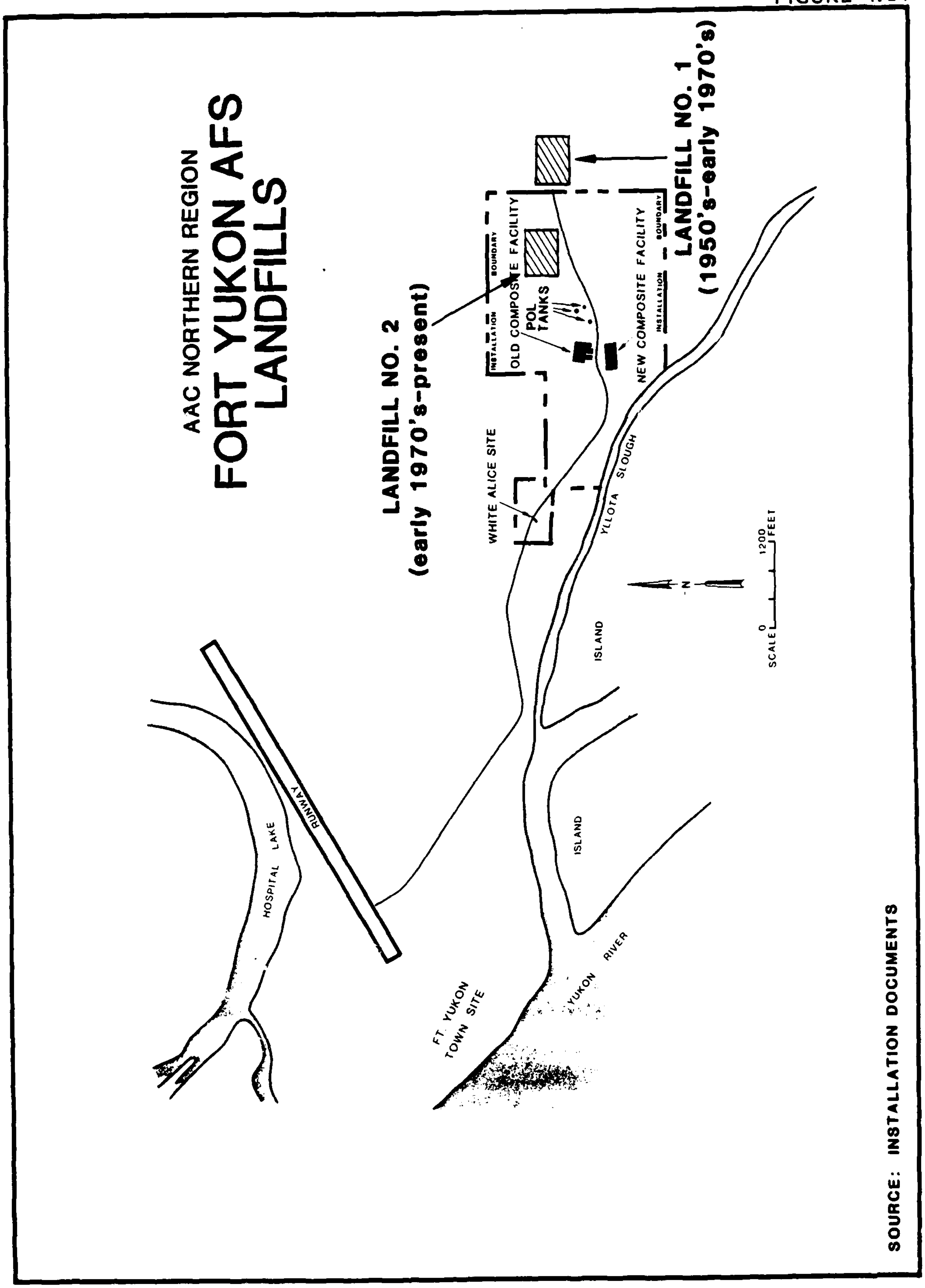
Two landfills have been used for disposal of wastes at Fort Yukon AFS. One of the landfills (Landfill No. 1) was used prior to the early 1970's. This landfill is located just beyond the eastern installation boundary. The other landfill (Landfill No. 2) is located north of the waste storage area and has been used since the early 1970's. The locations of these landfills are shown in Figure 4.21. Landfill No. 2 is a trench and cover operation. The open landfill trench is approximately 12-feet deep. Between 1973 and February 1985, incinerator ash was the predominant waste that was disposed of in the landfill. Since February 1985, wastes have been burned on the ground, adjacent to the landfill prior to landfilling. The wastes are periodically covered with sand. Probably very little hazardous waste was disposed of in this landfill,

FIGURE 4.20



AAC NORTHERN REGION
CAPE LISBURNE AFS LANDFILL

SOURCE: INSTALLATION DOCUMENTS



SOURCE: INSTALLATION DOCUMENTS

since waste petroleum products were used as a dust suppressant on base roads until 1984. Oil and solvents that were not used for dust control were accumulated in the waste storage area. In 1982, 600 to 700 drums of petroleum based wastes that had accumulated in the waste storage area were shipped off base to DPDO at Elmendorf AFB for disposal. These drums had accumulated over a period of several years. Wastes such as oily rags, paints and thinners were also not disposed of in the landfill because they were burned in the incinerator.

Little information was obtained concerning the landfill that was operated prior to the early 1970's. However, this landfill operated prior to the installation of the incinerator. Therefore, it is more likely that wastes such as oily rags, paints and thinners were disposed of in Landfill No. 1 than in the current landfill. Also, AAC personnel who were present at the installation during the period of operation of Landfill No. 1 consider it likely that some waste oils and other hazardous wastes were disposed at the site.

Indian Mountain AFS

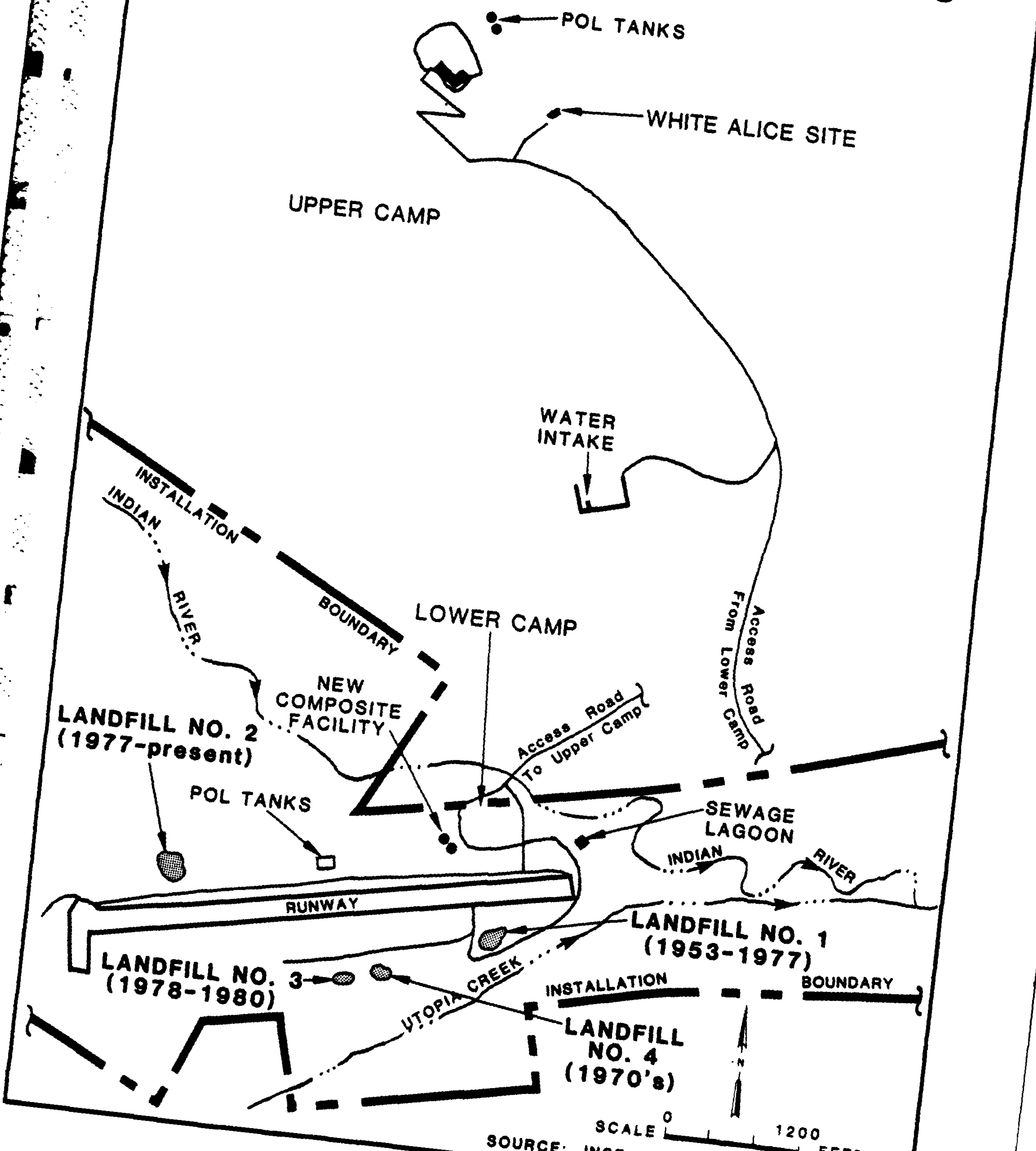
No landfill operations took place at the Indian Mountain Upper Camp but four landfill areas have been identified at the Lower Camp (Figure 4.22). Landfill No. 1 is approximately a one-acre area located on the south side of the runway adjacent to a gravel pit which operated along Utopia Creek. This landfill operated from 1953 to 1977. It has a fill depth of 10 to 20 feet. Burning of wastes was regularly practiced. Wastes buried include garbage, rubbish, scrap lumber and metal from construction and demolition operations and other small quantities of shop wastes such as paint cans, rags with oils and solvents, oil spill residues, etc. Road oiling routinely took place during this time so it is unlikely that much liquid industrial wastes went to this landfill.

Landfill No. 2 started operating in 1977 and is the current active disposal area at the installation. This landfill utilized trenches approximately 15 to 20 feet deep at a site (about one acre) located north of the runway. Incinerator ash, wood, metal, oil filters, empty drums, fuel absorbents, oil spill soil residues, paint residues, and construction/demolition debris were buried at the site. Combustible material was usually burned.

FIGURE 4.22

AAC NORTHERN REGION

INDIAN MOUNTAIN AFS LANDFILLS



SOURCE: INSTALLATION DOCUMENTS

Landfill No. 3 is an area (about 0.2 acre) south of the runway which was used for burying scrap metal, drums, wood and other materials obtained during a general cleanup of the Lower Camp from 1978 to 1980. Landfill No. 4 is a site adjacent to Landfill No. 3 and is approximately the same size. This site was used to bury 50 to 100 drums found scattered in the immediate vicinity of the runway. As discussed previously, these were the remnants of a waste accumulation area that probably operated in the area. Numerous additional drums were observed in the wooded area around the landfill during the site visit for this study.

Kotzebue AFS

There is one inactive landfill at Kotzebue AFS as shown in Figure 4.23. This landfill was used until approximately 1972; burning of waste occurred on a regular basis. The landfill was located on a triangular piece of land northeast of the fuel storage tanks on the beach. The landfill was located adjacent to Waste Accumulation Area No. 2. In 1975, the landfill and waste accumulation area were cleaned up. The wastes that were stored in drums in the accumulation area were shipped to DPDO at Elmendorf AFB for disposal. Petroleum based wastes in drums that were leaking were used for dust control. Empty drums were disposed of in the community dump. The ground in the vicinity of the landfill and the waste accumulation area was graded. Although most of the wastes were removed from the area, some of the wastes were buried in the landfill.

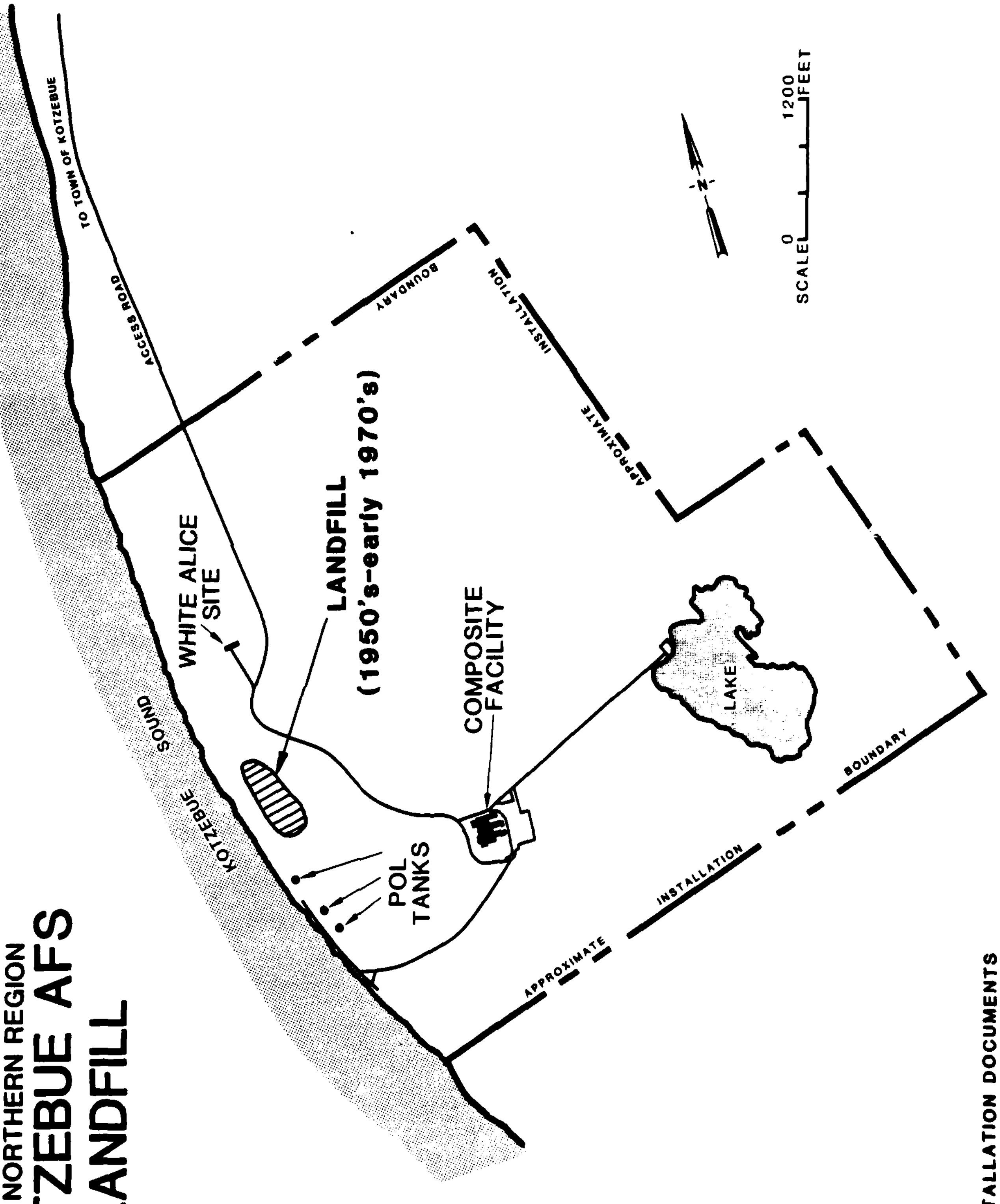
There are no active landfills at Kotzebue AFS. Since 1972 garbage and rubbish have been disposed of in the community dump. Waste oil, spent solvents and waste diesel fuel have been used for dust control or shipped to DPDO at Elmendorf AFB for disposal.

Murphy Dome AFS

Three landfills were identified as being used by the Murphy Dome AFS installation (Figure 4.24). The initial operation (Landfill No. 1) was located about 0.5 mile northwest of the helicoptor landing area. Access to the site is along an unimproved road; the landfill is situated where the road divides and goes two different directions. This site is approximately an acre in size with fill depths of 10 to 15 feet. Garbage, rubbish, wood, metal, plastic, drums and other debris have been

FIGURE 4.23

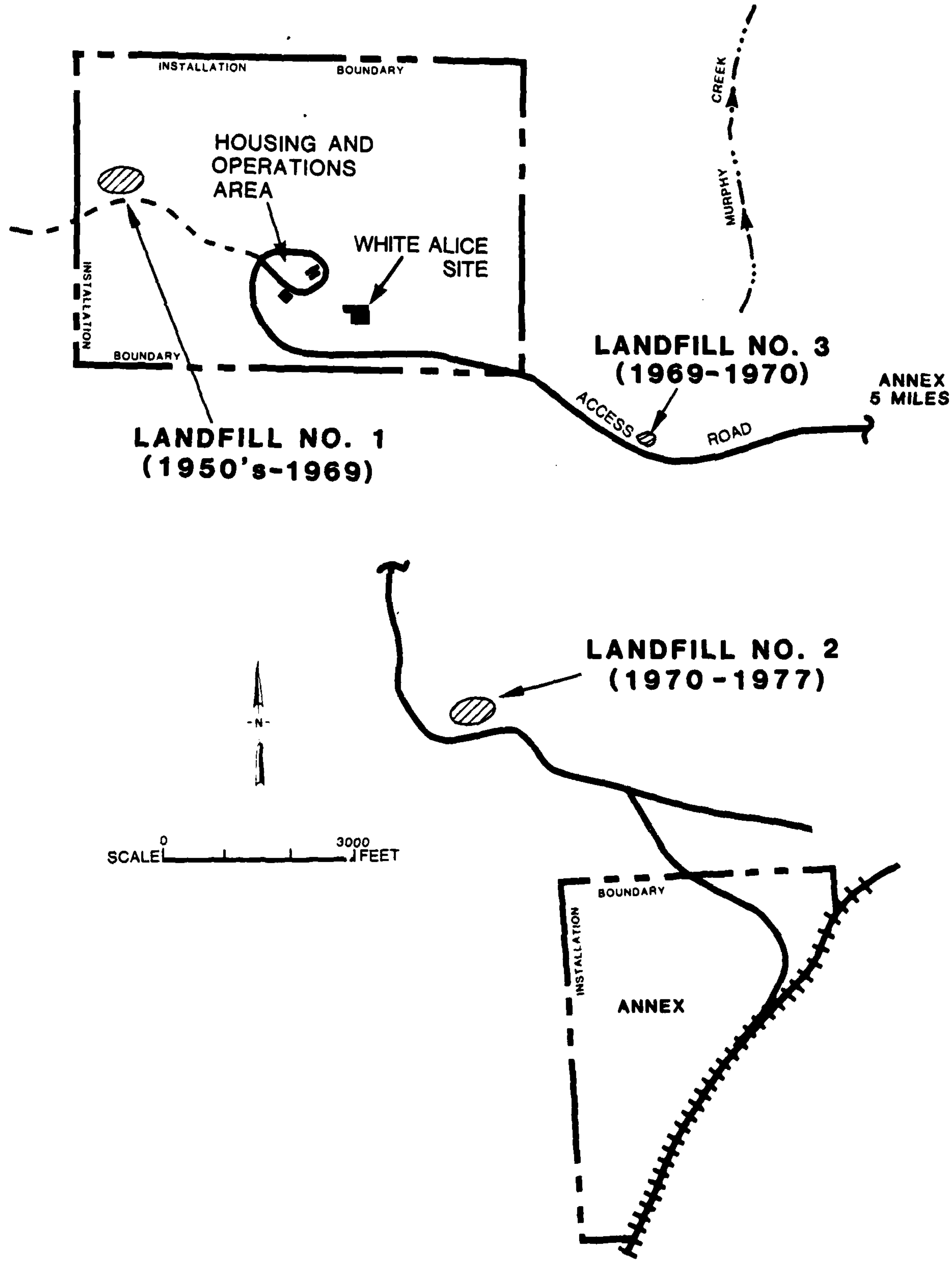
AAC NORTHERN REGION
KOTZEBUE AFS LANDFILL



SOURCE: INSTALLATION DOCUMENTS

FIGURE 4.24

AAC NORTHERN REGION
MURPHY DOME AFS LANDFILLS



SOURCE: INSTALLATION DOCUMENTS

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buried at the site. Burning of wastes was practiced. This site operated until 1969.

Landfill No. 2 is located about 6 miles southeast of the installation adjacent to the main access road. This site is off installation property but was solely used by the Air Force from 1970 to 1977. The site is approximately one acre and fill depths were approximately 8 to 10 feet. Garbage, rubbish, incinerator ash, wood, plastic, metal and other wastes similar to those disposed at Landfill No. 1 were taken to this site. Wastes were burned at the landfill.

Landfill No. 3 is a site used for only about a year or two (1969-1970). This site was quickly abandoned due to lack of adequate cover material at the site.

Tin City AFS

There has been only one landfill site at Tin City AFS as shown in Figure 4.25. It is located east of the runway. The landfill is a trench and fill operation. During the winter months trash, garbage, scrap metal, packing materials, empty paint cans, oily rags, etc. are hauled to the landfill and stockpiled. During the summer months when the soil can be excavated, the wastes are put into landfill trenches and covered. A large percentage of the hazardous wastes generated at the installation consist of petroleum-based wastes. These wastes are combustible and have been given to the nearby tin mine, where they were burned in furnaces. However, small quantities of these wastes are suspected of being disposed of in the landfill. Also in the late 1970's, 35,000 gallons of diesel fuel is suspected of having been burned in a pit in the vicinity of the landfill.

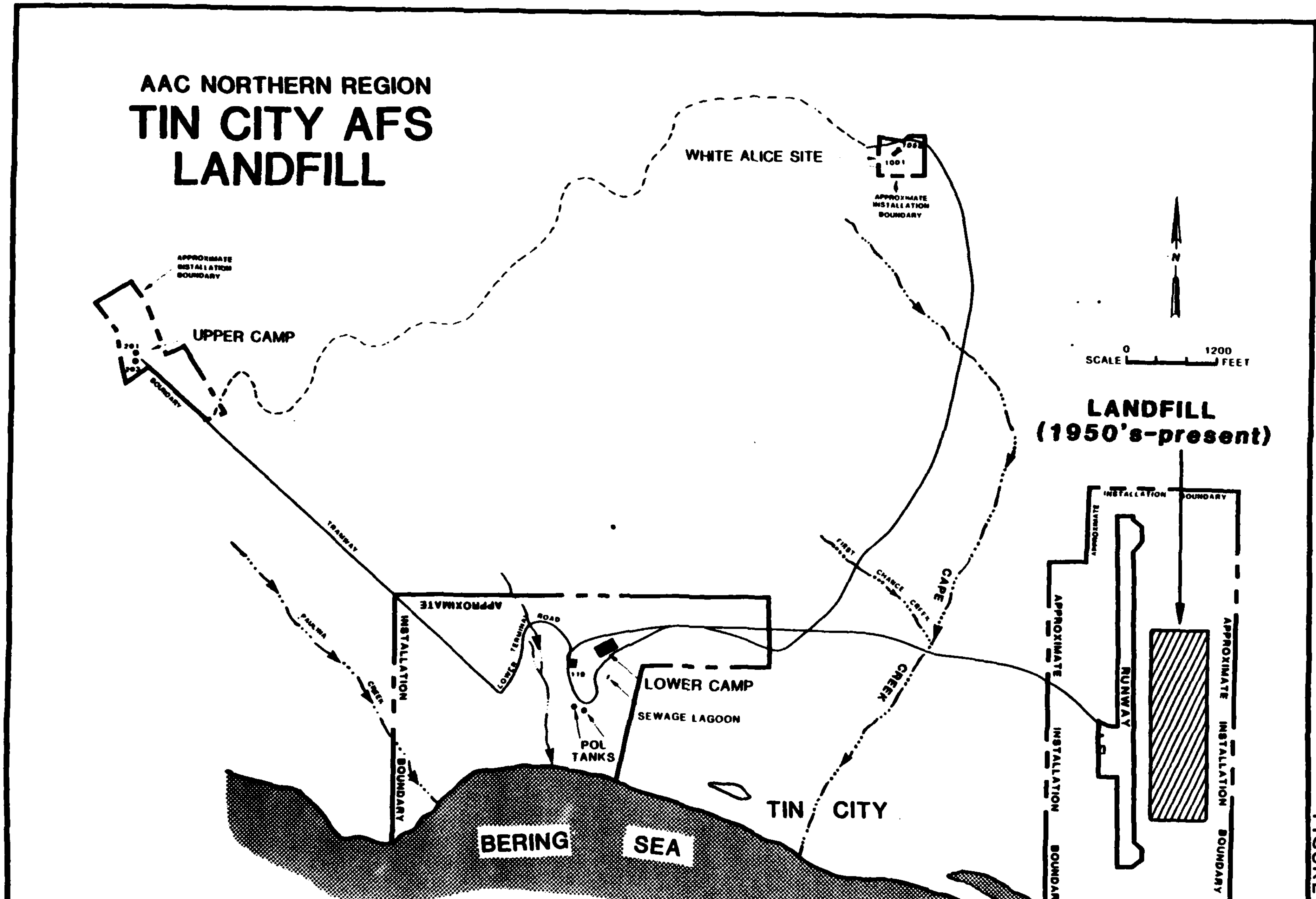
Dumps

Dumps that are discussed in this subsection are different from landfills (previously discussed) in that landfills are relatively controlled disposal sites. The AAC dumps, however, have had a very random pattern of disposal with no cover operations.

Galena AFS, Campion AFS, Fort Yukon AFS, Kotzebue AFS and Murphy Dome AFS

No dumps have been identified at Galena AFS, Campion AFS, or the LRR sites at Fort Yukon, Kotzebue and Murphy Dome.

FIGURE 4.25



SOURCE: INSTALLATION DOCUMENTS

Cape Lisburne AFS

There have been two dumps at Cape Lisburne AFS. The locations of the dumps are shown in Figure 4.26. Dump No. 1 has been previously discussed as a waste accumulation area adjacent to the base landfill. This dump was used up to 1977-1978 when a cleanup of the installation was conducted. At this time accumulated waste oils were removed from the dump and shipped off base for disposal to DPDO at Elmendorf AFB. Most of the damaged drums were placed in overpacks for shipment, however, some of the drums were buried in the landfill and the dump. Old vehicles, tanks and large metal objects were used as rip rap between the beach and the runway. The metal objects were covered with large rocks blasted off the mountain.

The second dump (Dump No. 2) was located in the valley south of the Upper Camp. This dump received wastes that were generated in operations at the Upper Camp and White Alice Communications System (WACS) site. Garbage, rubbish, scrap lumber, scrap metal, empty drums and drums of waste oil and material were thrown, or sometimes blown, off the top of the mountain. This dump was cleaned up in the late 1970's. Drums containing waste oils were removed from the valley and shipped off the installation. Empty drums were crushed and buried in the landfill. Scrap material was either removed from the valley or covered with rocks.

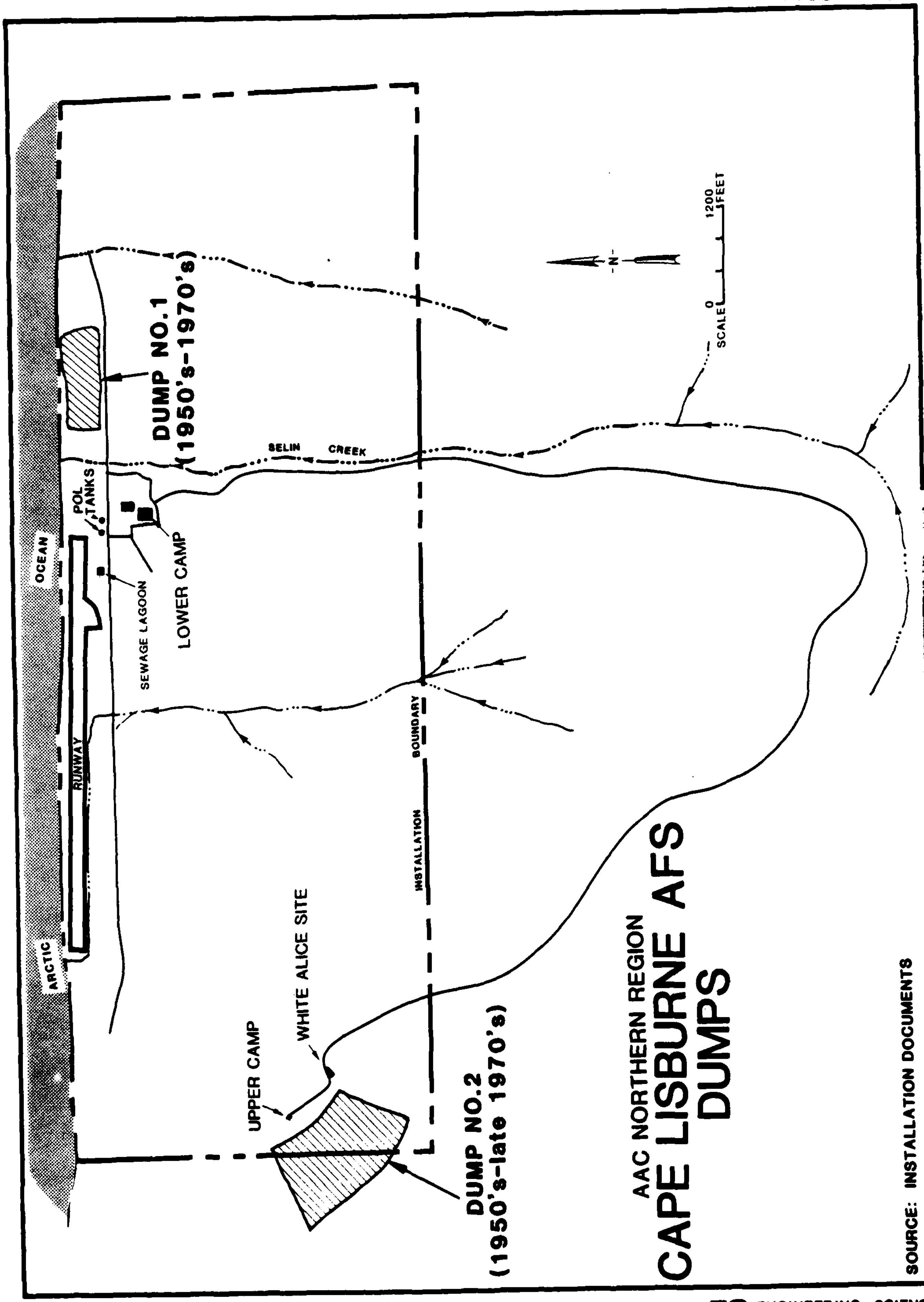
Indian Mountain AFS

Many of the wastes generated at the Upper Camp and White Alice site were disposed off the western and eastern sides of the mountain (Figure 4.27). The material disposed consisted of rubbish, wood, metal, drums, plastic and other debris. Some of the drums were partially filled with oil, ethylene glycol or other residuals. In the period 1978-1980 a general cleanup of the Upper Camp was performed. Wastes were moved to several burial sites on the mountain (Figure 4.27). Drums (estimates up to 10,000 were crushed before burial and any remaining liquids were collected for shipment off the installation.

Tin City AFS

Two general dump areas have been identified at Tin City AFS as shown in Figure 4.28. One of these dump areas (Dump No. 1) was located in the valleys beneath the Upper Camp. The other dump area (Dump No. 2) was located beneath the Lower Camp, between the Lower Camp and the tin

FIGURE 4.26



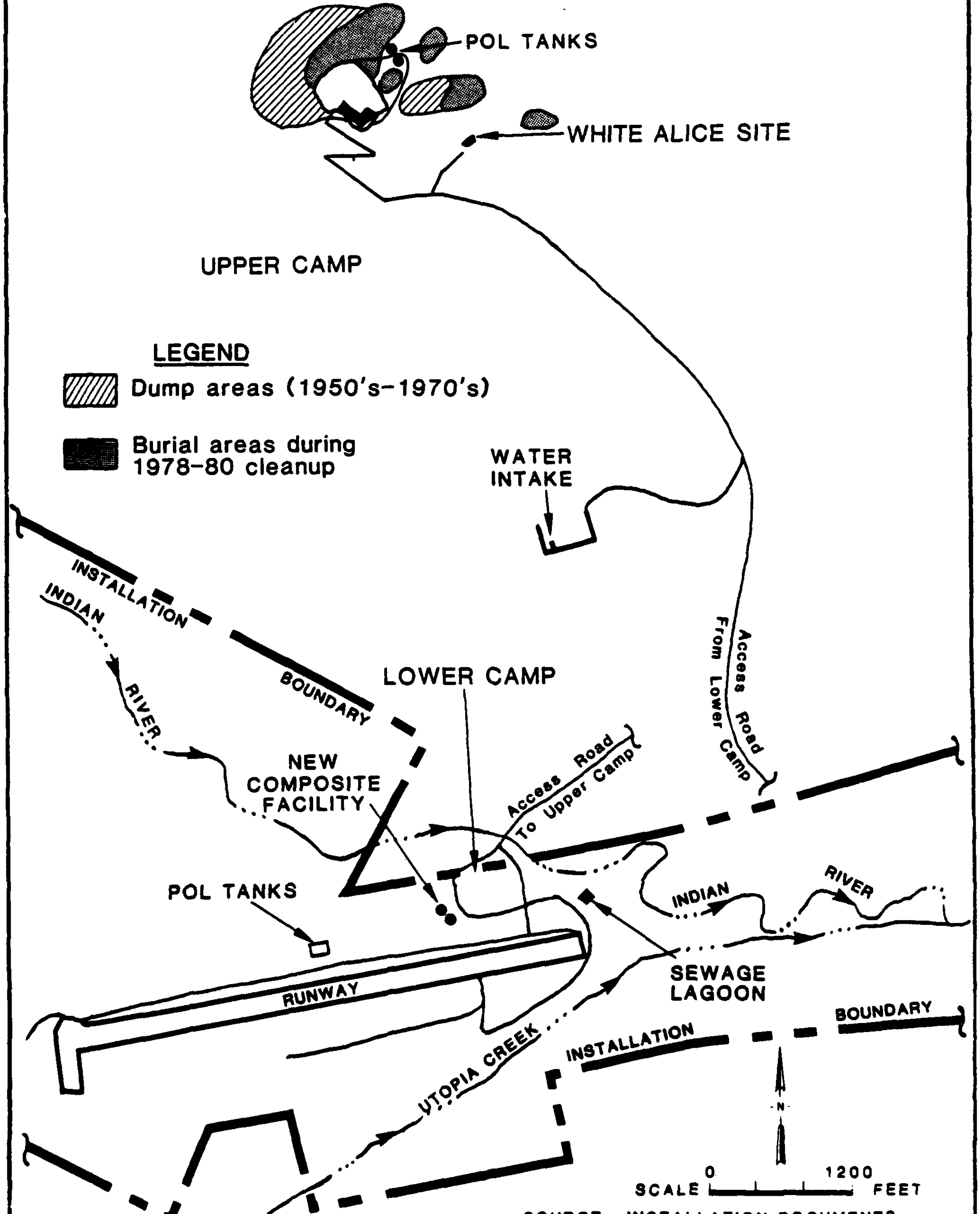
AAC NORTHERN REGION
CAPE LISBURNE AFS
DUMPS

SOURCE: INSTALLATION DOCUMENTS

ES ENGINEERING - SCIENCE

AAC NORTHERN REGION

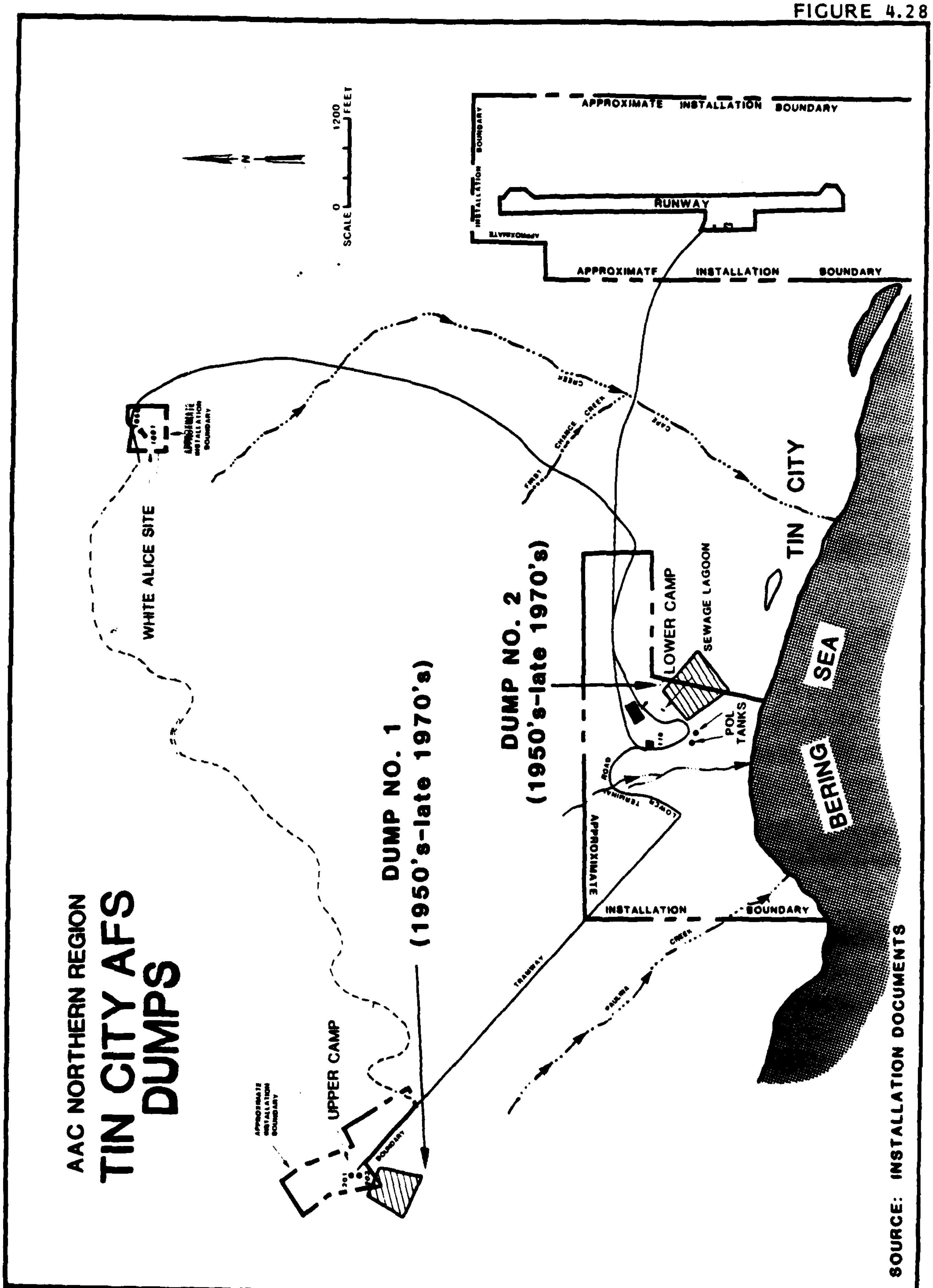
INDIAN MOUNTAIN AFS DUMPS



SOURCE: INSTALLATION DOCUMENTS

ES ENGINEERING-SCIENCE

FIGURE 4.28



AAC NORTHERN REGION
TIN CITY AFS
DUMPS
DUMP NO. 1
(1950's-late 1970's)
DUMP NO. 2
(1950's-late 1970's)
UPPER CAMP
WHITE ALICE SITE
LOWER CAMP
SEWAGE LAGOON
POL TANKS
TIN CITY
BERING SEA
RUNWAY
APPROXIMATE INSTALLATION BOUNDARY
APPROXIMATE INSTALLATION BOUNDARY
APPROXIMATE INSTALLATION BOUNDARY
FIRST CHANCE CREEK
TRAMWAY
LOWER TERMINAL ROAD
SCALE 0 1200 FEET
N
SOURCE: INSTALLATION DOCUMENTS

mine site. Empty drums, drums of used and unused oil, scrap metal and lumber, garbage and refuse were thrown and/or blown into these areas. Wastes from these dumps were collected during site cleanups conducted in 1978 and 1984. Waste oils and other wastes were shipped off base for disposal. Scrap metal, wood, broken equipment, etc., was buried in the installation landfill.

Hardfills

Galena AFS, Campion AFS, Fort Yukon AFS, Kotzebue AFS and Tin City AFS

No hardfills have been identified at Galena AFS, Campion AFS and the LRR sites at Fort Yukon, Kotzebue and Tin City.

Cape Lisburne AFS

One hardfill area has been identified at Cape Lisburne AFS (Figure 4.29). This hardfill was used to prevent erosion of the runway. Old tanks, vehicles, etc., were placed into the Chukchi Sea and covered with rock. There is no indication that hazardous wastes were disposed of in this area.

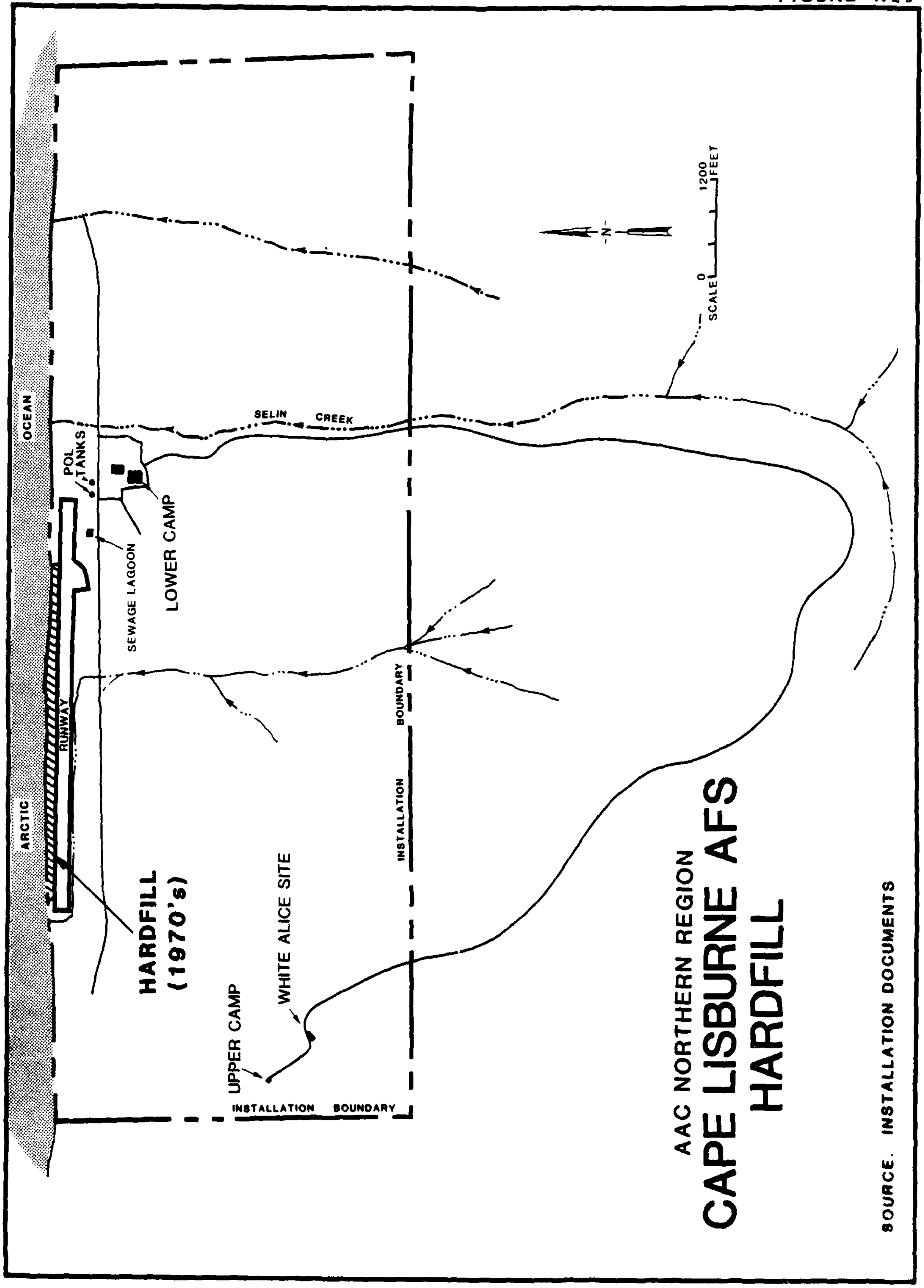
Indian Mountain AFS

Two hardfills were identified at Indian Mountain (Figure 4.30). One small hardfill (Hardfill No.1) was used in the 1970's just south of the western turnaround area of the runway. This area received construction and demolition debris. Another area (Hardfill No. 2) used for hardfill was along the south bank of the Indian River where it borders the Lower Camp. This area contains scrap metal, wood and other typical construction waste.

Murphy Dome AFS

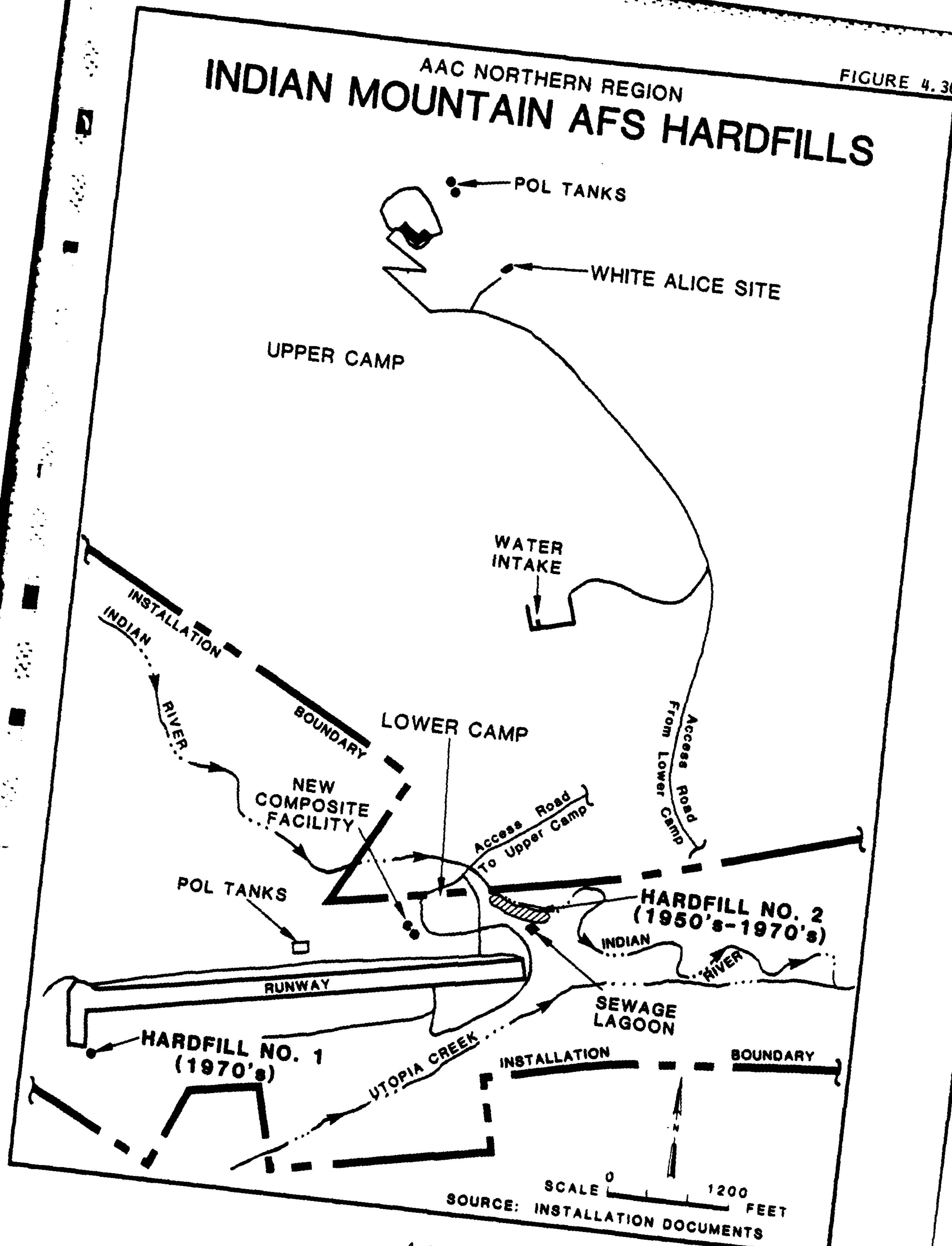
Two hardfills were operated at Murphy Dome (Figure 4.31). One site (Hardfill No. 1) was located near the helicopter landing area just south of the unimproved road which leads to Landfill No. 1. Another site (Hardfill No. 2) is located south of the bulk fuel storage area. Both sites have some evidence of concrete, wood, pipe and scrap metal from construction and demolition operations at the surface. Hardfill No. 2 currently has equipment and other debris stored on the ground and not buried yet.

FIGURE 4.29

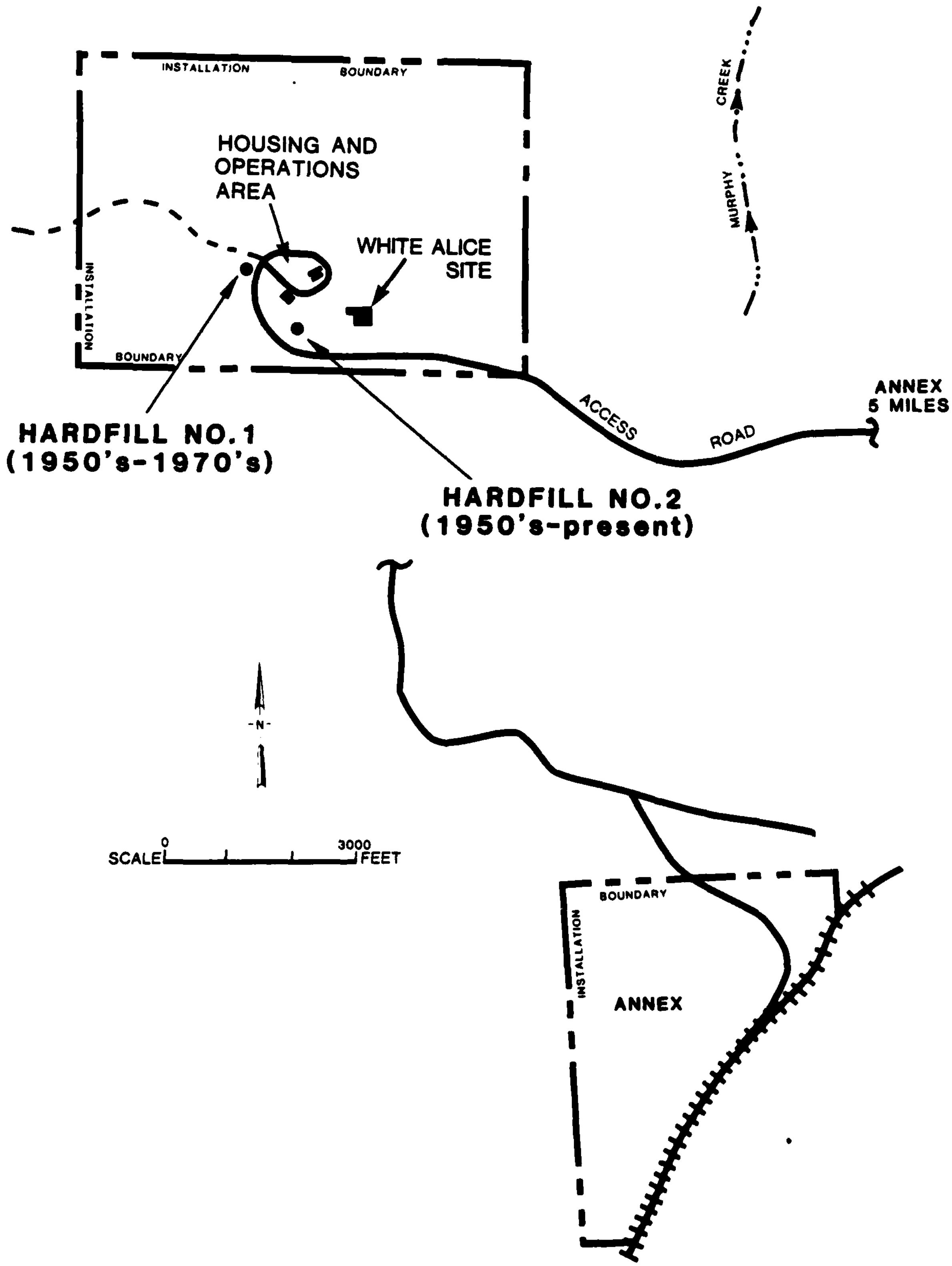


AAC NORTHERN REGION
CAPE LISBURNE AFS
HARDFILL

SOURCE. INSTALLATION DOCUMENTS


AAC NORTHERN REGION
INDIAN MOUNTAIN AFS HARDFILLS
FIGURE 4.30
POL TANKS
WHITE ALICE SITE
UPPER CAMP
WATER
INTAKE
INSTALLATION
BOUNDARY
INDIAN
RIVER
LOWER CAMP
Access Road
From Lower Camp
NEW
COMPOSITE
FACILITY
Access Road
To Upper Camp
POL TANKS
HARDFILL NO. 2
(1950's-1970's)
INDIAN
RIVER
RUNWAY
SEWAGE
LAGOON
HARDFILL NO. 1
(1970's)
UTOPIA CREEK
INSTALLATION
BOUNDARY
N
SCALE
0
1200
FEET
SOURCE: INSTALLATION DOCUMENTS

AAC NORTHERN REGION
MURPHY DOME AFS HARDFILLS



SOURCE: INSTALLATION DOCUMENTS

Ground Application

Most all of the AAC Northern installations have applied some waste liquids to roads and/or runways primarily for controlling dust and additionally for disposal purposes.

Galena AFS

Waste oils, hydraulic fluids, spent solvents, waste fuels and other shop wastes generated at Galena AFS were applied to the Galena Airport roads until 1983-1984. These materials were accumulated by the USAF and provided to the State of Alaska since the State had the responsibility for maintaining roads and grounds at the installation. The oily wastes assisted in controlling the ultra-fine dust particles typically found in the Galena soils.

Campion AFS

A large portion of the oils and other petroleum-based shop wastes generated at Campion AFS were accumulated and then hauled to Galena Airport. At the airport, the roads were oiled by the State to minimize the dust problems.

Cape Lisburne AFS

According to installation personnel, road oiling is not currently practiced at Cape Lisburne AFS. However, a permit for oiling the runway for 1984 was found in AAC files. Oiling the runway was practiced as a waste disposal method and for dust control at Cape Lisburne AFS prior to the mid-1970's.

Fort Yukon AFS

Road oiling for dust suppression and disposal of wastes was extensively practiced at Fort Yukon AFS. Waste oils, spent solvents, ethylene glycol and other shop wastes were used on installation roads until 1984. A tanker for application of oil to roads was present at the facility during the site visit.

Indian Mountain AFS

At Indian Mountain AFS waste oils, solvents, ethylene glycol and other shop residuals were combined and until 1984 used on the extensive road and runway system at the installation, primarily the road between the two camps. Wastes were accumulated during inclement weather and applied to the roads during the summer months as a dust palliative and disposal method.

Kotzebue AFS

Waste oils, spent solvents, ethylene glycol and other shop wastes were used on the installation road system at Kotzebue AFS. The use of oil for dust control and as a waste disposal method was practiced until 1984.

Murphy Dome AFS

Waste oils and other shop wastes at Murphy Dome were used to oil roads until approximately 1972.

Tin City AFS

According to installation personnel, road oiling is not currently practiced at Tin City AFS. However, a permit for oiling the runway for 1984 was found in AAC files. Oiling the runway for dust control was practiced prior to the mid-1970's.

Explosive Ordnance Disposal

Cape Lisburne AFS, Fort Yukon AFS, Indian Mountain AFS, Kotzebue AFS, Murphy Dome AFS and Tin City AFS

None of the long-range radar sites included in this study of the AAC Northern installations has had any disposal sites for explosives and munitions.

Galena AFS

G lena AFS has had an area located outside the airport levee used for disposal of explosives and munitions. This area is located about 0.3 miles northeast on property not currently under USAF jurisdiction. Combustion of explosives and munitions at explosive ordnance disposal (EOD) areas is normally conducted in ground pits. The materials combusted are solid and small residue quantities result. Due to the small quantities and solid nature of the material, contaminant migration is expected to be minimal.

Campion AFS

Campion AFS had a small EOD area located one mile southeast of the installation at the location where the road makes a sharp turn to the southwest. Since the installation did not have a flying mission, it is understood this site was not used extensively for munitions disposal.

Incinerators

Incinerators were installed in the early 1970's to burn garbage and refuse generated at the installations. Waste oils and diesel fuel were often used as auxiliary fuel to burn the solid wastes. At some installations incinerators were installed at both the Upper and the Lower Camp. Most of these incinerators are currently not in service because of the reduced volume of wastes generated at the installations. Also, the units have been frequently out of service due to mechanical problems. Ash from the incinerators was buried in landfills.

Sanitary Sewerage Systems

Sanitary sewerage systems have been provided at the AAC Northern Region installations since the beginning. In the 1950's most wastewater was discharged without treatment. In the 1960's and early 1970's treatment systems were constructed. All of the Upper Camps are serviced by septic tanks. The Lower Camps have aerated lagoons for sewage treatment. Galena AFS was served by a settling tank followed by discharge to a leaching field outside the airport levee. In 1973 an aerated lagoon replaced the settling tank. Septic tanks have also served a few of the remote buildings at Galena AFS. Five oil-water separators at vehicle maintenance, POL and hangar locations provide pretreatment of shop wastes prior to entering the Galena AFS sewerage system. Campion AFS has been served by a package secondary treatment plant since 1973. Murphy Dome has a wastewater treatment facility but is using the old septic tanks due to the significantly reduced flows which currently exist. Very little hazardous materials were discharged to the sewerage systems. Diluted, and usually neutralized, battery acid is the most typical industrial-type waste normally handled.

Surface Drainage Systems

Due to the steep slopes and extensive rock found at most of the AAC Northern Region installations, extensive drainage systems have not been required. Galena AFS is an exception since pumps are required to lift interior airport drainage over the flood/control dikes during high Yukon River stages. Most surface drainage at the installations takes place as overland flow and some ditches. While the surface drainage systems may have received hazardous waste residuals from spills and leaks or leach-

ate from disposal areas, dumping of materials directly in the surface drainage system has not occurred.

Selkregg (1976c) published photographs of sheet piling floodwall construction at Galena AFS in 1964. Sheet piling was driven into the alluvium of the Yukon River embankment to form an outer flood protection barrier. The area behind the floodwall (from a photograph) was back-filled using steel drums. It is assumed that the drums were originally filled with POL, chemicals or other raw materials shipped to Galena AFS. Presumably, the empty drums were filled with sand, gravel and crushed rock and were placed in rows behind the sheet piling wall. Some of the drums utilized in this construction project may have contained unknown quantities of residual waste materials.

<u>Miscellaneous Disposal Areas</u>

White Alice Communications Systems (WACS) sites were used to provide communications for the LRR installations. These communication systems were constructed in the late 1950's and used until the late 1970's. When these facilities were constructed, most electrical equipment had insulating oils containing PCBs. The WACS sites had high power requirements; and therefore, large numbers of transformers, capacitors, switchgear, and replacement PCB oil were present at the sites. Samples of oil taken for routine analysis and waste oils from equipment were normally disposed of on the ground in the vicinity of these sites.

The AAC has removed most PCB equipment and oil from the WACS sites as part of the Alaskan Cleanup Effort (ACE program). The following subsections present site specific information related to the cleanup of these sites from information contained in AAC files and from interviewees.

<u>Galena AFS</u>

There was no White Alice Communications System site at Galena AFS. Communications were provided by the site at Campion AFS.

<u>Campion AFS</u>

No information was located in installation files with regard to the removal of contaminated soils at Campion AFS. Some soil testing appeared to have been done. It was indicated this facility had less oil-related equipment than other WACS sites and probably less oil disposal

on the site. The site was dismantled with salvageable equipment shipped off base and demolition debris buried in the installation landfill.

Cape Lisburne AFS

Information concerning cleanup efforts at the WACS site at Cape Lisburne AFS was obtained from annual commander's site summary reports and other installation documents. The WACS site was officially deactivated in 1979. In 1980 equipment, furniture and supplies were shipped off base on the annual supply barge. PCB oil and transformers were still in storage at the installation in 1982. Cleanup activities at this site were scheduled for 1984, but were cancelled due to inclement weather.

Fort Yukon AFS

The initial WACS site cleanup was conducted in 1981. Transformers were drained and removed from the building. All floor tiles in the main building were removed and treated as PCB contaminated waste.

In 1983, a second cleanup team investigated contaminated soils in the areas beneath doorways. Contaminated soils (i.e., PCB greater than 50 ppm) were removed from areas around Buildings 1001 and 1018. In 1984, 144 drums of contaminated soil were shipped to Elmendorf AFB.

Indian Mountain AFS

Information concerning removal of WACS equipment, oil and soil was not extensive for Indian Mountain AFS. Building demolition was taking place during the site visit for this study. It is understood that equipment was removed in the past few years. File data indicates soil testing and some soil removal took place around the Lower Camp. It is also noted that 85 drums of PCB contaminated oil and 240 drums of PCB contaminated soil were removed from the Indian Mountain WACS site.

Kotzebue AFS

The site cleanup at Kotzebue AFS was conducted in 1983. Samples of soil were collected and composited from areas near doorways. These samples were evaluated in the field for PCBs. Samples from areas with stains indicating oil spills were not included in the composite samples. These samples were also evaluated in the field for PCB contamination. Contaminated scils were removed from an area 15 feet wide by 20 feet long adjacent to and under Building 1001. Soil was removed to a depth of 5 feet. The soil was placed in 108 drums and stored in the waste

accumulation area adjacent to Building 205. These drums were removed from the installation in 1984. The facilities of the former WACS site are currently used by the Alaskan Air National Guard.

Murphy Dome AFS

No information concerning the status of cleanup at the White Alice site at Murphy Dome was available. It was reported this WACS facility may have been comparable to Campion AFS with less oil-related equipment at the site. Alascom took over the White Alice building at Murphy Dome.

Tin City AFS

Little information was obtained from installation or AAC files with regard to the cleanup at the White Alice site at Tin City AFS. The U.S. Navy has been a tenant in the White Alice facilities since 1979.

EVALUATION OF PAST DISPOSAL ACTIVITIES AND FACILITIES

Review of past waste generation and management practices at the AAC Northern Region installations has resulted in identification of 125 sites and/or activities which were considered as areas of concern for potential contamination and migration of contaminants:

- Galena AFS - 15
- Campion AFS - 14
- Cape Lisburne AFS - 15
- Fort Yukon AFS - 11
- Indian Mountain AFS - 31
- Kotzebue AFS - 12
- Murphy Dome AFS - 15
- Tin City AFS - 12

Sites Eliminated from Further Evaluation

The sites and/or activities of initial concern were evaluated using the Flow Chart presented in Figure 1.2. Sites/activities not considered to have a potential for contamination were deleted from further evaluation. The sites which have potential for contamination and migration of contaminants were evaluated using the Hazard Assessment Rating Methodology (HARM). Table 4.3 summarizes the results of the flow chart logic for each of the areas of initial concern.

TABLE 4.3
SUMMARY OF FLOW CHART LOGIC FOR AREAS OF
INITIAL HEALTH, WELFARE AND ENVIRONMENTAL CONCERN
AT AAC NORTHERN REGION INSTALLATIONS

Installation/Site	Location*	Potential Hazard to Health, Welfare or Environment	Need for Further IRP Evaluation/ Action	HARM Rating
Galena AFS				
Waste Accumulation Area	-	Yes	Yes	Yes
POL Tank Farm	-	Yes	Yes	Yes
Spill/Leak No. 1	-	Yes	Yes	Yes
Spill/Leak No. 2	-	Yes	Yes	Yes
Spill/Leak No. 3	-	Yes	Yes	Yes
Spill/Leak No. 4	-	Yes	Yes	Yes
Spill/Leak No. 5	-	Yes	Yes	Yes
Pesticide Handling	-	No	No	No
Fire Protection Training Area	-	Yes	Yes	Yes
Landfill	-	Yes	No	No
Road Oiling	-	Yes	No	No
EOD Area	-	No	No	No
Incinerator	-	No	No	No
Sanitary Sewerage System	-	No	No	No
Surface Drainage System	-	No	No	No
Campion AFS				
Waste Accumulation Area No. 1	-	Yes	Yes	Yes
Waste Accumulation Area No. 2	-	Yes	Yes	Yes
Spill/Leak No. 1	-	Yes	Yes	Yes
Spill/Leak No. 2	-	Yes	Yes	Yes
Pesticide Handling	-	No	No	No
Landfill No. 1	-	Yes	Yes	Yes
Landfill No. 2	-	Yes	Yes	Yes
Landfill No. 3	-	No	No	No
Road Oiling	-	Yes	No	No
EOD Area	-	No	No	No
Incinerator	-	No	No	No
Sanitary Sewerage System	-	No	No	No
Surface Drainage System	-	No	No	No
White Alice Site	-	Yes	Yes	Yes

*LC = Lower Camp; UC = Upper Camp

TABLE 4.3
SUMMARY OF FLOW CHART LOGIC FOR AREAS OF
INITIAL HEALTH, WELFARE AND ENVIRONMENTAL CONCERN
AT AAC NORTHERN REGION INSTALLATIONS
(Continued)

Installation/Site	Location*	Potential Hazard to Health, Welfare or Environment	Need for Further IRP Evaluation/ Action	HARM Rating
Cape Lisburne AFS				
Waste Accumulation				
Area No. 1	LC	No	No	No
Area No. 2	LC	Yes	Yes	Yes
Spill/Leak No. 1	LC	Yes	Yes	Yes
Spill/Leak No. 2	LC	Yes	Yes	Yes
Pesticide Handling	LC/UC	No	No	No
Fire Protection Training Area	LC	No	No	No
Landfill	LC	Yes	Yes	Yes
Dump No. 1	LC	Yes	Yes	Yes
Dump No. 2	UC	Yes	Yes	Yes
Hardfill	LC	No	No	No
Runway Oiling	LC	Yes	Yes	Yes
Incinerator	LC	No	No	No
Sanitary Sewerage System	LC/UC	No	No	No
Surface Drainage System	LC/UC	No	No	No
White Alice Site	UC	Yes	Yes	Yes
Fort Yukon AFS				
Waste Accumulation Area	--	Yes	Yes	Yes
Oil Discharge Beneath Power Plant	--	Yes	Yes	Yes
Pesticide Handling	--	No	No	No
Fire Protection Training Area	--	No	No	No
Landfill No. 1	--	Yes	Yes	Yes
Landfill No. 2	--	No	No	No
Road Oiling	--	Yes	Yes	Yes
Incinerator	--	No	No	No
Sanitary Sewerage System	--	No	No	No
Surface Drainage System	--	No	No	No
White Alice Site	--	Yes	Yes	Yes

*LC = Lower Camp; UC = Upper Camp

TABLE 4.3
SUMMARY OF FLOW CHART LOGIC FOR AREAS OF
INITIAL HEALTH, WELFARE AND ENVIRONMENTAL CONCERN
AT AAC NORTHERN REGION INSTALLATIONS
(Continued)

Installation/Site	Location*	Potential Hazard to Health, Welfare or Environment	Need for Further IRP Evaluation/ Action	HARM Rating
Indian Mountain AFS				
Waste Accumulation				
Area No. 1	LC	Yes	Yes	Yes
Area No. 2	LC	No	No	No
Area No. 3	LC	Yes	Yes	Yes
Area No. 4	LC	Yes	Yes	Yes
Area No. 5	LC	Yes	Yes	Yes
Area No. 6	UC	Yes	Yes	Yes
Spill/Leak No. 1	LC	Yes	Yes	Yes
Spill/Leak No. 2	UC	Yes	Yes	Yes
Spill/Leak No. 3	LC	Yes	Yes	Yes
Spill/Leak No. 4	LC	Yes	Yes	Yes
Spill/Leak No. 5	UC	Yes	Yes	Yes
Spill/Leak No. 6	UC	Yes	Yes	Yes
Spill/Leak No. 7	UC	Yes	Yes	Yes
Spill/Leak No. 8	LC	Yes	Yes	Yes
Spill/Leak No. 9	UC	Yes	Yes	Yes
Spill/Leak No. 10	UC	Yes	Yes	Yes
Spill/Leak No. 11	LC	Yes	Yes	Yes
Pesticide Handling	LC/UC	No	No	No
Fire Protection Training Area	LC	No	No	No
Landfill No. 1	LC	Yes	Yes	Yes
Landfill No. 2	LC	Yes	Yes	Yes
Landfill No. 3	LC	Yes	Yes	Yes
Landfill No. 4	LC	Yes	Yes	Yes
Dump Areas	UC	Yes	Yes	Yes
Hardfill No. 1	LC	No	No	No
Hardfill No. 2	LC	No	No	No
Road Oiling	LC/UC	Yes	Yes	Yes
Incinerator	LC/UC	No	No	No
Sanitary Sewerage System	LC/UC	No	No	No
Surface Drainage System	LC/UC	No	No	No
White Alice Site	UC	Yes	Yes	Yes

*LC = Lower Camp; UC = Upper Camp

TABLE 4.3
SUMMARY OF FLOW CHART LOGIC FOR AREAS OF
INITIAL HEALTH, WELFARE AND ENVIRONMENTAL CONCERN
AT AAC NORTHERN REGION INSTALLATIONS
(Continued)

Installation/Site	Location*	Potential Hazard to Health, Welfare or Environment	Need for Further IRP Evaluation/ Action	HARM Rating
Kotzebue AFS				
Waste Accumulation				
Area No. 1	--	Yes	Yes	Yes
Area No. 2	--	Yes	Yes	Yes
Spill/Leak No. 1	--	Yes	Yes	Yes
Spill/Leak No. 2	--	Yes	Yes	Yes
Spill/Leak No. 3	--	Yes	Yes	Yes
Pesticide Handling	--	No	No	No
Landfill	--	Yes	Yes	Yes
Road Oiling	--	Yes	Yes	Yes
Incinerator	--	No	No	No
Sanitary Sewerage System	--	No	No	No
Surface Drainage System	--	No	No	No
White Alice Site	--	Yes	Yes	Yes
Murphy Dome AFS				
Waste Accumulation				
Area No. 1	--	Yes	Yes	Yes
Area No. 2	--	Yes	Yes	Yes
Area No. 3	--	Yes	Yes	Yes
Bulk POL Storage Area Spills	--	Yes	Yes	Yes
Pesticide Handling	--	No	No	No
Landfill No. 1	--	Yes	Yes	Yes
Landfill No. 2	--	Yes	Yes	Yes
Landfill No. 3	--	No	No	No
Hardfill No. 1	--	No	No	No
Hardfill No. 2	--	No	No	No
Road Oiling	--	Yes	Yes	Yes
Incinerator	--	No	No	No
Sanitary Sewerage System	--	No	No	No
Surface Drainage System	--	No	No	No
White Alice Site	--	Yes	Yes	Yes

*LC = Lower Camp; UC = Upper Camp

TABLE 4.3
SUMMARY OF FLOW CHART LOGIC FOR AREAS OF
INITIAL HEALTH, WELFARE AND ENVIRONMENTAL CONCERN
AT AAC NORTHERN REGION INSTALLATIONS
(Continued)

Installation/Site	Location*	Potential Hazard to Health, Welfare or Environment	Need for Further IRP Evaluation/ Action	HARM Rating
Tin City AFS				
Waste Accumulation Area	LC	Yes	Yes	Yes
Spill/Leak No. 1	LC	Yes	Yes	Yes
Spill/Leak No. 2	LC	Yes	Yes	Yes
Pesticide Handling	LC/UC	No	No	No
Landfill	LC	Yes	Yes	Yes
Dump No. 1	LC	Yes	Yes	Yes
Dump No. 2	UC	Yes	Yes	Yes
Runway Oiling	LC	Yes	Yes	Yes
Incinerator	LC/UC	No	No	No
Sanitary Sewerage System	LC/UC	No	No	No
Surface Drainage System	LC/UC	No	No	No
White Alice Site	--	Yes	Yes	Yes

*LC = Lower Camp; UC = Upper Camp

Source: Engineering-Science

Fifty of the 125 sites and/or activities assessed did not warrant further evaluation. The rationale for omitting these sites/activities from HARM evaluation is discussed below.

Galena AFS

The landfill used at Galena AFS by the USAF is located off the base property. The facility has been jointly operated by the USAF and the community of Galena. Since this facility has not been on Air Force property and was not totally operated by the military, it will not be addressed further in this study. In a similar manner waste oils and other liquids were provided to the State of Alaska for applying to roads at the Galena Airport and vicinity. Since this was not an Air Force operation, it is also eliminated from further evaluation as a part of this study.

The EOD area combusted munitions and explosives. The residue after combustion is small and minimal migration is anticipated. The sanitary sewer and surface drainage systems have received insignificant quantities of hazardous wastes and are judged to present no environmental contamination. The incinerator is also eliminated from further consideration since the wastes were combusted and the ash buried in the landfill. Pesticide usage has been extremely minimal and does not represent a potential for contaminant migration.

Campion AFS

Landfill No. 3 at Campion AFS received primarily hardfill materials such as equipment, scrap metal, wood, etc. This site is considered to have minimal potential for environmental contamination. Road oiling is eliminated from further IRP assessment for the same reasons as discussed for Galena AFS.

The EOD area combusted small quantities of munitions and explosives. The residue is solid and minimal migration is expected. The sanitary sewer and surface drainage systems have received insignificant quantities of hazardous wastes and are judged to present no environmental contamination. The incinerator is also eliminated from further consideration due to the small quantities of materials handled and the combustion of any residuals. Pesticide usage has been extremely minimal and no exterior chemical mixing or container rinsing has been practiced.

Cape Lisburne AFS

The incinerator was eliminated from further consideration because the solid waste and waste oils were combusted. Residual ash was buried in the installation landfill. The sanitary sewer and surface drainage systems have received insignificant quantities of hazardous wastes and are judged to result in no environmental contamination.

A fire protection training area was identified in installation documents, however, no installation personnel could identify the period of use or the location of the training area. Fire training exercises at most LRR installations were conducted on a relatively small scale with minimal potential for adverse impact due to environmental contamination.

The hardfill along the installation runway was eliminated from further consideration, because the fill material consisted of old tanks, vehicles, etc. There is no indication that hazardous wastes were placed in this area. Waste Accumulation Area No. 1 was eliminated from further consideration, because the small quantity of wastes stored minimized contamination from leakage. Pesticide use at Cape Lisburne AFS has been minimal, therefore, handling of pesticides was eliminated from further consideration.

Fort Yukon AFS

Landfill No. 2 was eliminated from further evaluation, because most of the hazardous wastes generated at this installation have been used for road oiling when this landfill operated. Also, the installation incinerator operated nearly the entire life of the landfill. Miscellaneous shop wastes were burned in the incinerator prior to landfilling. Therefore, the quantity of hazardous wastes that have been disposed of in Landfill No. 2 are judged to be insignificant.

The fire protection training activities were conducted on a small scale. There is no indication of any adverse environmental impact because of the use of the area for training exercises; therefore, the site was eliminated from further consideration.

The incinerator was eliminated from further consideration because the wastes were combusted. Residual ash was buried in a landfill. Pesticide use at the facility has been minimal. Therefore, pesticide handling was eliminated from further assessment. The quantities of hazardous waste disposed to the sanitary sewer system or to the surface

drainage system are judged to be insignificant with little potential for environmental contamination.

Indian Mountain AFS

Waste Accumulation Area No. 2 was used to store waste oil drums from the Lower Camp power plant. Soils from this area were removed in 1984 and with the new power facilities the area has received little use for waste storage.

Hardfill Nos. 1 and 2 have received only construction and demolition debris. There is no evidence that hazardous materials were buried at the sites. Thus, these pose no potential for environmental contamination.

The sanitary sewer and surface drainage systems have received insignificant quantities of hazardous wastes and are judged to present no environmental contamination. The incinerator is also eliminated from further consideration due to the small quantities of materials handled and the combustion of any residuals. Pesticide usage has been extremely minimal and no exterior chemical mixing or container rinsing has been practiced.

A fire protection training pit was mentioned in the installation documents but no interviewees could identify the location. Fire protection training at most LRR installations has been minimal to none. It is probable this site had little usage and thus there is minimal potential for contaminant migration.

Kotzebue AFS

The incinerator was eliminated from further evaluation because the wastes were combusted with the residual ash disposed of in an off-base dump. Pesticide handling was eliminated from further consideration because of the minimal usage of pesticides. The sanitary sewer and surface drainage systems are considered to have minimal environmental contamination because the quantity of hazardous wastes disposed was insignificant.

Murphy Dome AFS

Hardfill Nos. 1 and 2 have received wood, metal and other scrap materials from construction and demolition operations. There is no evidence these sites received hazardous wastes; thus, there is minimal potential for environmental contamination. Landfill No. 3 was operated

for only one to two years, thus any hazardous materials would be extremely small. Most of the liquid wastes were being applied to the roads when this landfill operated. Therefore, this site is judged to have minimal potential for environmental contamination.

The incinerator has been eliminated from further evaluation since minimal quantities of hazardous materials were combusted. The sanitary sewerage systems and surface drainage systems were also eliminated as they do not constitute a potential for environmental contamination from hazardous materials. Pesticide handling has been minimal and does not represent a potential for contaminant migration.

Tin City AFS

The incinerator was eliminated from further consideration because the wastes were combusted. Residual ash was buried in the installation landfill. Pesticide use at the base has been minimal. Therefore, pesticide handling was eliminated from further assessment. The quantities of hazardous waste disposed to the sanitary sewer or surface drainage system are judged to be insignificant and thus result in minimal potential for contamination.

Sites Evaluated Using HARM

The remaining 75 sites identified in Table 4.3 were evaluated using the Hazard Assessment Rating Methodology. The HARM process takes into account characteristics of potential receptors, waste characteristics, pathways for migration, and specific characteristics of the site related to waste management practices. Results of the HARM analysis for the sites are summarized in Table 4.4. In a number of instances, several of the sites have been combined for the HARM rating due to their close proximity to each other. This procedure reduced the number of sites actually receiving HARM ratings from 75 to 55 as summarized below:

		Sites/Activities Requiring Analysis	Combined Sites Receiving HARM Rating
o	Galena AFS -	8	6
o	Campion AFS -	7	7
o	Cape Lisburne AFS -	8	6
o	Fort Yukon AFS -	5	5
o	Indian Mountain AFS -	23	11
o	Kotzebue AFS -	8	5
o	Murphy Dome AFS -	8	7
o	Tin City AFS -	8	8

The procedures used in the HARM system are outlined in Appendix G and the specific rating forms for the AAC Northern Region sites are presented in Appendix H. The HARM system is designed to indicate the relative need for follow-on action.

TABLE 4.4
SUMMARY OF HARM SCORES FOR
POTENTIAL CONTAMINATION SITES
AT AAC NORTHERN REGION INSTALLATIONS

Installation/ Site (Location)*	Receptor Subscore	Waste Charac-teristics Subscore	Pathways Subscore	Waste Management Factor	HARM Score
Galena AFS					
Waste Accumulation Area	87	72	80	1.0	80
Spill/Leak No. 1	87	90	48	1.0	75
Spill/Leak No. 2	87	90	48	1.0	75
POL Tank Farm and Spill/ Leak Nos. 4 and 5	87	72	48	1.0	69
Fire Protection Training Area	87	72	48	1.0	69
Spill/Leak No. 3	87	54	48	1.0	63
Campion AFS					
Landfill No. 1	57	72	48	1.0	59
Spill/Leak No. 1	65	54	48	1.0	56
Waste Accumulation Area No. 2	65	54	48	1.0	56
Landfill No. 2	65	54	48	1.0	56
Spill/Leak No. 2	59	54	48	1.0	54
Waste Accumulation Area No. 1	59	54	48	1.0	54
White Alice Site	59	40	48	1.0	49
Cape Lisburne AFS					
Spill/Leak No. 1 (LC)	79	72	61	1.0	71
Dump No. 2 (UC)	66	72	61	1.0	67
Spill/Leak No. 2 (LC)	66	72	61	1.0	66
Landfill and Waste Accumulation Area No. 2/Dump No. 1 (LC)	77	54	56	1.0	62
Runway Oiling (LC)	79	36	41	1.0	52
White Alice Site (UC)	66	40	40	1.0	49
Fort Yukon AFS					
Road Oiling	82	54	48	1.0	61
Waste Accumulation Area	82	54	41	1.0	59
Landfill No. 1	80	54	41	1.0	58

*(LC) = Lower Camp; (UC) = Upper Camp

TABLE 4.4
SUMMARY OF HARM SCORES FOR
POTENTIAL CONTAMINATION SITES
AT AAC NORTHERN REGION INSTALLATIONS
(Continued)

Installation/ Site (Location)*	Receptor Subscore	Waste Charac- teristics Subscore	Pathways Subscore	Waste Management Factor	HARM Score
<u>Fort Yukon AFS</u> (Continued)					
Oil Discharge Beneath Power Plant	82	54	33	1.0	56
White Alice Site	80	40	41	1.0	54
<u>Indian Mountain AFS</u>					
Spill/Leak Nos. 1, 3 and 8 (LC)	79	90	63	1.0	77
Waste Accumulation Area No. 4 and Landfill Nos. 3 and 4 (LC)	79	72	63	1.0	71
Waste Accumulation Area No. 6 and Spill/ Leak Nos. 2, 5, 6, 7, 9 and 10 (UC)	44	90	68	1.0	67
Landfill No. 1 (LC)	79	54	63	1.0	65
Waste Accumulation Area No. 1 (LC)	79	54	63	1.0	65
Waste Accumulation Area No. 3 and Spill/ Leak Nos. 4 and 11 (LC)	79	54	63	1.0	65
Waste Accumulation Area No. 5 (LC)	79	54	63	1.0	65
Road Oiling (LC/UC)	79	54	63	1.0	65
Dump Areas (UC)	44	72	75	1.0	64
Landfill No. 2 (LC)	69	54	63	1.0	62
White Alice Site (UC)	44	40	68	1.0	51
<u>Kotzebue AFS</u>					
Spill/Leak Nos. 1, 2 & 3	36	90	100	1.0	75
Waste Accumulation Area No. 2/Landfill	49	54	54	1.0	52

*(LC) = Lower Camp; (UC) = Upper Camp

TABLE 4.4
SUMMARY OF HARM SCORES FOR
POTENTIAL CONTAMINATION SITES
AT AAC NORTHERN REGION INSTALLATIONS
(Continued)

Installation/ Site (Location)*	Receptor Subscore	Waste Characteristics Subscore	Pathways Subscore	Waste Management Factor	HARM Score
Kotzebue AFS (Continued)					
Road Oiling	51	54	48	1.0	51
Waste Accumulation Area No. 1	51	54	41	1.0	49
White Alice Site	51	40	48	1.0	46
Murphy Dome AFS					
Road Oiling	68	54	48	1.0	57
Landfill No. 2	64	54	48	1.0	55
Landfill No. 1	64	54	33	1.0	50
Waste Accumulation Area No. 1 and Bulk POL Storage Area Spills	64	54	33	1.0	50
Waste Accumulation Area No. 2	64	54	33	1.0	50
Waste Accumulation Area No. 3	64	54	33	1.0	50
White Alice Site	68	40	41	1.0	50
Tin City AFS					
Dump No. 1 (UC)	82	54	68	1.0	68
Landfill (LC)	73	72	41	1.0	62
Dump No. 2 (LC)	81	54	48	1.0	61
Waste Accumulation Area (LC)	77	54	48	1.0	60
Spill/Leak No. 2 (LC)	77	54	48	1.0	60
Spill/Leak No. 1	64	54	48	1.0	55
White Alice Site	64	40	48	1.0	51
Runway Oiling (LC)	73	36	41	1.0	50

*(LC) = Lower Camp; (UC) = Upper Camp

NOTE: HARM Score = [(Receptors + Waste Characteristics + Pathways) x 1/3] x Waste Management Factor

Source: Engineering-Science

SECTION 5
CONCLUSIONS

The goal of the IRP Phase I study is to identify sites where there is potential for environmental contamination resulting from past waste disposal practices and to assess the probability of contamination migration from these sites. The conclusions given below are based on field inspections; review of records and files; review of the environmental setting; interviews with installation personnel, past employees and state and federal government employees; and assessments using the HARM system. Table 5.1 (located at the end of this section) contains a list of the potential contamination sources identified at the AAC Northern Region installations, enumerates the HARM scores for those sites, and presents the conclusion and need for follow-on action. An overview of the conclusions for each installation is presented in the following subsections.

GALENA AFS

All six sites evaluated at Galena AFS were concluded to have sufficient potential to create environmental contamination and follow-on investigation is warranted. HARM scores for these sites ranged from 69-80. Receptor subscores were high at all sites due to their location on the Yukon River flood plain. Waste characteristics subscores were highly influential on the HARM scores for Spill/Leak Nos. 1 and 2. At several sites, there was evidence of POL contamination. POL spills ranging from 300 to 30,000 gallons were recorded.

CAMPION AFS

Seven sites were evaluated at Campion AFS, all of which were concluded to have sufficient potential to create environmental contamination and follow-on investigation is warranted. The HARM scores were ranged from 49 to 59. Receptor and waste characteristic subscores

primarily influenced the HARM ratings. No major spills or leaks were noted at this installation, and many sites resulted from chronic minor leaks and spills over a long period of time. POL seepage outside the dike surrounding bulk storage facility was reported.

CAPE LISBURNE AFS

Six sites were assessed using the HARM system at Cape Lisburne AFS. All six sites were concluded to have sufficient potential to create environmental contamination and warrant follow-on investigation. Two sites at the Upper Camp and four sites at the Lower Camp were rated. HARM scores ranged from a low of 49 (White Alice Site) to 71 (Spill/Leak No. 1). Receptors or waste characteristics subscores had the greatest influence on the final HARM scores. Partial cleanup has occurred at several sites, although no fuel was recovered from the two sites with reported spills and leaks.

FORT YUKON AFS

A total of five sites were evaluated using the HARM system at Fort Yukon AFS, all of which are considered to have potential to create environmental contamination. Each site warrants follow-on investigation. The HARM scores were all closely grouped, ranging from 54 to 61. The receptors subscore was the most significant component of the HARM scores at Fort Yukon.

INDIAN MOUNTAIN AFS

At Indian Mountain AFS, eleven sites were evaluated using the HARM system and each of the eleven sites was found to have sufficient potential to create environmental contamination. Follow-on investigations are warranted at each site. The HARM ratings ranged from 51 to 77, with over half of the sites rating 60 or above. Five sites involved waste accumulation areas, each scoring 65 or above. All site ratings were significantly influenced by pathways and receptor subscores. Numerous leaks and spills of diesel fuel have occurred at Indian Mountain LRR, and were evenly divided between the Upper and Lower Camps. Although most spills were below 10,000 gallons, one major spill was reported for the Upper Camp (46,500 gal) and two major spills (29,000 and 33,000 gal)

at the Lower Camp, were noted. Recovery was significant (approximately 80%) at the Lower Camp, however, recovery at the Upper Camp was not as complete, primarily due to the complex environmental setting.

KOTZEBUE AFS

A total of five sites were evaluated using the HARM system at Kotzebue AFS. From this evaluation only four were concluded to have sufficient potential to create environmental contamination. Follow-on investigation is recommended for these four sites. It was concluded that the remaining site had minimal potential to create environmental contamination and no follow-on action is recommended. The Spill/Leak Nos. 1, 2 and 3 site received a HARM score of 75. Waste Accumulation Area No. 2/Landfill received a HARM score of 52. Road Oiling and Waste Accumulation Area No. 1 received scores of 51 and 49, respectively. Spill/Leak Nos. 1, 2, and 3 were created by overfills and equipment failures. Obvious signs of contamination were evident during the site visit.

MURPHY DOME AFS

Seven sites at Murphy Dome AFS were evaluated using the HARM system and all seven were concluded to have sufficient potential to create environmental contamination. Follow-on investigation is warranted at each site. HARM scores ranged from 50 to 57 with five of the seven sites rating at 50. The receptor subscore was the most influential of the three subscores used in determining the final HARM scores.

TIN CITY AFS

A total of eight sites were evaluated at Tin City AFS using the HARM system. Each of the eight sites has sufficient potential to create environmental contamination and follow-on investigation is warranted. HARM scores ranged from 50 to 68. Receptors subscores influenced HARM scores significantly at each site.

TABLE 5.1

CONCLUSIONS CONCERNING SITES EVALUATED AT AAC NORTHERN REGION INSTALLATIONS

Rank	Installation/ Site (Location)[1]	Operation Period	Site Description	HARM Score[2]	Main Factors Impacting Total HARM Score: Receptors	Main Factors Impacting Total HARM Score: Waste Characteristics	Main Factors Impacting Total HARM Score: Pathways	Sufficient Potential To Create Environmental Contamination[3]	Follow-on Action Warranted[3]
Galena AFS									
1.	Waste Accumulation Area	1950's-Present	Evidence of spills and leaks of stored wastes, primarily POL.	80	X		X	Yes	Yes
2.	Spill/Leak No. 1	1940's-1960's	Disposal of residuals of AVGAS, JP-4, JP-1, diesel fuel, solvents and thinners from a large number of drums.	75	X	X		Yes	Yes
3.	Spill/Leak No. 2	Mid-1950's	Underground fuel transfer line from barge unloading area leaked between 20,000 to 30,000 gal. of diesel fuel. Recovery was incomplete.	75	X	X		Yes	Yes
4.	POL Tank Farm and Spill/Leak Nos. 4 and 5	1950's-present, 1985, 1980's	POL leaks (200 to 500 gal.) from recent fillstand incident, drainage of water/fuel, and POL Tank sludge disposal at this site.	69	X			Yes	Yes
5.	Fire Protection Training Area	Late 1950's - Present	Shallow soil combustion pit, burned fuels and shop wastes during training exercises.	69	X			Yes	Yes
6.	Spill/Leak No. 3	1984	Truck accident lost 4,000 gal. JP-4. Recovery was incomplete.	63	X			Yes	Yes
Campion AFS									
1.	Landfill No. 1	1950's-1970's	A trench and fill operation south of camp received refuse and some shop wastes.	59		X		Yes	Yes

(1) (LC) = Lower Camp; (UC) = Upper Camp
(2) This ranking was obtained using the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.
(3) These conclusions are based on field inspections, file data, interviews, environmental setting and HARM assessments.
Source: Engineering-Science

TABLE 5.1
CONCLUSIONS CONCERNING SITES EVALUATED AT AAC NORTHERN REGION INSTALLATIONS
(Continued)

Rank	Installation/ Site (Location)[1]	Operation Period	Site Description	HARM Score[2]	Main Factors Impacting Total HARM Score: Receptors	Waste Characteristics	Pathways	Sufficient Potential To Create Environmental Contamination[3]	Follow-on Action Warranted[3]
Campion AFS (Continued)									
2.	Spill/Leak No. 1	1950's-1983	Spills and leaks associated with bulk storage tank area; evidence of POL seepage outside dike.	56	X			Yes	Yes
3.	Waste Accumulation Area No. 2	1950's-1983	Spills and leaks occurred at storage area for drummed waste products.	56	X			Yes	Yes
4.	Landfill No. 2	1970's-1983	A trench and fill operation south-east of camp received general refuse and shop wastes from installation.	56	X			Yes	Yes
5.	Spill/Leak No. 2	1950's-1983	Spills and leaks occurred at storage area for unused products by barge landing area.	54	X			Yes	Yes
6.	Waste Accumulation Area No. 1	1950's-1983	Spillage occurred at primary storage area for drummed waste material and unused products, stained soils removed in 1983 (partial cleanup).	54	X			Yes	Yes
7.	White Alice Site	1958-1978	Suspected spills and leaks of transformer oils containing PCBs.	49	X			Yes	Yes
Cape Lisburne AFS									
1.	Spill/Leak No. 1 (LC)	1980	Tank overfill resulted in 3,000 gal. diesel fuel spill; no fuel recovery.	71	X	X		Yes	Yes
2.	Dump No. 2 (UC)	1950's - Late 1970's	Valley area received refuse, waste oils and misc. liquid products. Partial cleanup in 1973.	67		X		Yes	Yes

(1) (LC) = Lower Camp; (UC) = Upper Camp
(2) This ranking was obtained using the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.
(3) These conclusions are based on field inspections, file data, interviews, environmental setting and HARM assessments.
Source: Engineering-Science

TABLE 5.1
CONCLUSIONS CONCERNING SITES EVALUATED AT AAC NORTHERN REGION INSTALLATIONS
(Continued)

Rank	Installation/ Site (Location)[1]	Operation Period	Site Description	HARM Score[2]	Main Factors Impacting Total HARM Score: Receptors	Waste Characteristics	Pathways	Sufficient Potential To Create Environmental Contamination[3]	Follow-on Action Warranted[3]
Cape Lisburne AFS (Continued)									
3.	Spill/Leak No. 2 (LC)	1982	AVGAS fuel bladder (NOAA) ruptured spilling 1,500 gal.; no fuel recovery.	66		X		Yes	Yes
4.	Landfill and Waste Accumulation Area No. 2/Dump No. 1 (LC)	1950's-Present, 1950's-1070's	Landfill received refuse, shop wastes, chlorinated solvents; operated as a ravine fill with biannual cover and periodic burns. Leaks and buried oily wastes from waste accumulation and Dump No. 1 also at the landfill site.	62	X			Yes	Yes
5.	Runway Oiling (LC)	1950's-1970's	Waste oils applied to runway for dust control and disposal.	52	X			Yes	Yes
6.	White Alice Site (LC)	1957-1979	Suspected disposal of oils containing PCBs onto ground.	49	X			Yes	Yes
Fort Yukon AFS									
1.	Road Oiling	1950's-1984	Roads routinely received applications of waste oils, spent solvents and ethylene glycol for dust control and disposal.	61	X			Yes	Yes
2.	Waste Accumulation Area	1950's-Present	Long-term storage area for waste with evidence of leaks and spills in a sandy area.	59	X			Yes	Yes
3.	Landfill No. 1	1950's-Early 1970's	Suspected disposal site for oily rags, solvents, thinners and paints prior to incinerator operation.	58	X			Yes	Yes

(1) (LC) = Lower Camp; (UC) = Upper Camp
(2) This ranking was obtained using the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.
(3) These conclusions are based on field inspections, file data, interviews, environmental setting and HARM assessments.
Source: Engineering-Science

TABLE 5.1
CONCLUSIONS CONCERNING SITES EVALUATED AT AAC NORTHERN REGION INSTALLATIONS
(Continued)

Rank	Installation/ Site (Location)[1]	Operation Period	Site Description	HARM Score[2]	Main Factors Impacting Total HARM Score			Sufficient Potential To Create Environmental Contamination[3]	Follow-on Action Warranted[3]
					Receptors	Waste Characteristics	Pathways		
Fort Yukon AFS (Continued)									
4.	Oil/Fuel Discharge	1950's-1984	Floor drains at power plant discharge to ground.	56	X			Yes	Yes
5.	White Alice Site	1958-1980	Suspected disposal of oil containing PCBs on ground.	54	X			Yes	Yes
Indian Mountain AFS									
1.	Spill/Leak Nos. 1, 3, and 8 (LC)	1973, 1974, 1977	Spills and leaks totaling over 60,000 gallons of POL, with about 80% recovery.	77	X	X		Yes	Yes
2.	Waste Accumulation Area No. 4 and Landfill Nos. 3 and 4 (LC)	1950's-1960's, 1978-1980, 1970's	Spill and leaks (primarily POL); evidence of a large number of drums previously stored at this site. Two small landfills at this site contain refuse and 50-100 drums from cleanup of waste accumulation area.	71	X	X		Yes	Yes
3.	Waste Accumulation Area No. 6 and Spill/Leak Nos. 2, 5, 6, 7, 9 and 10 (UC)	1950's-Late 1970's, 1973, 1977-78, 1979	Main accumulation area for waste oils and other liquids for UC. Multiple spills of POL ranging from 1,500 to 46,500 gallons.	67		X	X	Yes	Yes
4.	Landfill No. 1 (LC)	1953-1977	Disposal of refuse and some shop wastes such as paint cans, solvents and spill residues. Fill operation was 10-20 ft. with burning regularly practiced.	65	X		X	Yes	Yes
5.	Waste Accumulation Area No. 1 (LC)	1950's-Present	Main accumulation area for waste products, long-term use, leaks and spills evident, partial cleanup 1984.	65	X		X	Yes	Yes

(1) (LC) = Lower Camp; (UC) = Upper Camp
(2) This ranking was obtained using the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.
(3) These conclusions are based on field inspections, file data, interviews, environmental setting and HARM assessments.
Source: Engineering-Science

TABLE 5.1
CONCLUSIONS CONCERNING SITES EVALUATED AT AAC NORTHERN REGION INSTALLATIONS
(Continued)

Rank	Installation/ Site (Location)[1]	Operation Period	Site Description	HARM Score[2]	Main Factors Impacting Total HARM Score: Receptors	Waste Characteristics	Pathways	Sufficient Potential To Create Environmental Contamination[3]	Fo ow-on Action Warranted[3]
Indian Mountain AFS (Continued)									
6.	Waste Accumulation Area No. 3 and Spill/Leak Nos. 4 and 11 (LC)	1950's-1984, 1976, 1970's	Spills and leaks, primarily POL and other liquids from power plant operations. Leak No. 4 reported at 4,000 gal. of POL within dike area. Leak No. 11 from oil storage at power plant and fuel line leakage.	65	X		X	Yes	Yes
7.	Waste Accumulation Area No. 5 (LC)	1960's-1970's	Spills and leaks from wastes stored by road to UC. Cleanup in 1980 removed oil drums at this site.	65	X		X	Yes	Yes
8.	Road Oiling (LC/UC)	1950's-1984	Waste oils and other shop wastes (solvents, ethylene glycol, etc.) routinely applied to roads as dust control/disposal.	65	X		X	Yes	Yes
9.	Dump Areas (UC)	1950's-1970's	Dumping of drums and other materials from shops at UC containing oil, ethylene glycol and other residuals.	64		X	X	Yes	Yes
10.	Landfill No. 2 (LC)	1977-Present	Disposal of some shop wastes and spill residues buried in trenches 15-20 ft. deep; burning practiced.	62	X		X	Yes	Yes
11.	White Alice Site (UC)	1958-1979	Suspected spills, leaks, and disposal of oils containing PCBs.	51			X	Yes	Yes

(1) (LC) = Lower Camp; (UC) = Upper Camp
(2) This ranking was obtained using the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.
(3) These conclusions are based on field inspections, file data, interviews, environmental setting and HARM assessments.
Source: Engineering-Science

TABLE 5.1
CONCLUSIONS CONCERNING SITES EVALUATED AT AAC NORTHERN REGION INSTALLATIONS
(Continued)

Rank	Installation/ Site (Location)[1]	Operation Period	Site Description	HARM Score[2]	Main Factors Impacting Total HARM Score: Receptors	Waste Characteristics	Pathways	Sufficient Potential To Create Environmental Contamination[3]	Follow-on Action Warranted[3]
Kotzebue AFS									
1.	Spill/Leak Nos. 1, 2, and 3	Mid-1970's, 1979-1980, 1984	Multiple POL releases due to overfill and equipment failure. Approximately 4,000 gal. of diesel fuel recovered, but more likely remains. Ground is stained with diesel fuel, and fuel present in trenches, adjacent streams. Vegetative stress evident.	75		X	X	Yes	Yes
2.	Waste Accumulation Area No. 2/Landfill	1950's-Early 1970's	Past accumulation area for POL wastes on beach site now graded and drums removed in early 1970's. Landfill suspected of receiving waste POL and residue from cleanup of waste accumulation area in 1972.	52		X	X	Yes	Yes
3.	Road Oiling	1950's-1984	Waste oils, solvents, ethylene glycol, other shop liquid wastes applied to roads for dust control and waste disposal.	51	X	X		Yes	Yes
4.	Waste Accumulation Area No. 1	1950's-Present	Long-term use as accumulation area for waste oils and other wastes; noted evidence of recent leaks.	49	X	X		Yes	Yes
5.	White Alice Site	1957-1979	Suspected PCB contamination from disposal of oil on ground.	46	X		X	No	No
Murphy Dome AFS									
1.	Road Oiling	1950's-1972	Waste oils and other shop wastes applied to roads for dust control and disposal.	57	X	X		Yes	Yes

(1) (LC) = Lower Camp; (UC) = Upper Camp
(2) This ranking was obtained using the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.
(3) These conclusions are based on field inspections, file data, interviews, environmental setting and HARM assessments.
Source: Engineering-Science

TABLE 5.1
CONCLUSIONS CONCERNING SITES EVALUATED AT AAC NORTHERN REGION INSTALLATIONS
(Continued)

Rank	Installation/ Site (Location)[1]	Operation Period	Site Description	HARM Score[2]	Main Factors Impacting Total HARM Score: Receptors	Waste Characteristics	Pathways	Sufficient Potential To Create Environmental Contamination[3]	Follow-on Action Warranted[3]
Murphy Dome AFS (Continued)									
2.	Landfill No. 2	1970-1977	Disposal of refuse, some shop waste, drums and other debris.	55	X	X		Yes	Yes
3.	Landfill No. 1	1950's-1969	Disposal of refuse, some shop wastes and drums.	50	X	X		Yes	Yes
4.	Waste Accumulation Area No. 1 and Bulk POL Storage Area Spills	1970-Present 1970-1981	POL releases totaling 9,000 gals. with significant recovery; accumulation area for waste oils, other waste liquids from motor pool, possible leaks from various unused products also stored in vicinity.	50	X	X		Yes	Yes
5.	Waste Accumulation Area No. 2	1950's-1972	Early site used for accumulation of waste oils and other liquids from power plant; suspected leaks and spills.	50	X	X		Yes	Yes
6.	Waste Accumulation Area No. 3	1950's-1970's	Accumulation point for waste oils, waste liquids and unused products. The 1978 cleanup removed 50 drums of oil; several were rusted and probably emptied contents onto ground.	50	X	X		Yes	Yes
7.	White Alice Site	1950's-1970's	Suspected spills and leaks of oil contaminated with PCB.	50	X			Yes	Yes
Tin City AFS									
1.	Dump No. 1 (UC)	1950's-Late 1970's	Refuse, scrap metal, unused POL wastes disposed of off top of mountain into adjacent valleys; partial cleanup in 1978 and 1984.	68	X		X	Yes	Yes

(1) (LC) = Lower Camp; (UC) = Upper Camp
(2) This ranking was obtained using the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.
(3) These conclusions are based on field inspections, file data, interviews, environmental setting and HARM assessments.
Source: Engineering-Science

TABLE 5.1
CONCLUSIONS CONCERNING SITES EVALUATED AT AAC NORTHERN REGION INSTALLATIONS
(Continued)

Rank	Installation/ Site (Location)[1]	Operation Period	Site Description	HARM Score[2]	Main Factors Impacting Total HARM Score			Sufficient Potential To Create Environmental Contamination[3]	Follow-on Action Warranted[3]
					Receptors	Waste Characteristics	Pathways		
Tin City AFS (Continued)									
2.	Landfill (LC)	1950's-Present	Landfill has received waste oils, non-chlorinated solvents and other shop wastes at a trench and fill (summer only) operation. Also 25,000 gallons of diesel suspected of having been burned in a pit at the site.	62	X	X		Yes	Yes
3.	Dump No. 2 (LC)	1950's-Late 1970's	Refuse, scrap metal, and POL were disposed of in this area; partial cleanup in 1978 and 1984.	61	X	X		Yes	Yes
4.	Waste Accumulation Area (LC)	1950's-Present	Long-term waste accumulation area for waste oils, unused oils and ethylene glycol products. Evidence of leaks and spills; no major incidents reported.	60	X	X		Yes	Yes
5.	Spill/Leak No. 2 (LC)	1979	Spill of 300 gallons of diesel fuel at White Alice; none was recovered.	60	X	X		Yes	Yes
6.	Spill/Leak No. 1	1980	Spill of 850 gallons of diesel fuel; no fuel was recovered.	55	X	X		Yes	Yes
7.	White Alice Site	1958-1975	Suspected disposal of oil containing PCBs on ground.	51	X			Yes	Yes
8.	Runway Oiling (LC)	1950's-1970's	Liquid shop wastes (oils, ethylene glycol, solvents, etc.) applied to the runway for dust control and disposal.	50	X			Yes	Yes

(1) (LC) = Lower Camp; (UC) = Upper Camp
(2) This ranking was obtained using the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.
(3) These conclusions are based on field inspections, file data, interviews, environmental setting and HARM assessments.
Source: Engineering-Science

SECTION 6

RECOMMENDATIONS

Fifty-five sites were identified in the Alaskan Air Command Northern Region for potential environmental contamination. These sites have been evaluated and rated using the HARM system which assesses their relative potential for contamination and establishes the basis for determining the need for additional investigations under Phase II IRP. Fifty-four of the 55 sites have sufficient potential to create environmental contamination and warrant Phase II investigations. The sites evaluated have been reviewed for applicable land use restrictions.

PHASE II MONITORING RECOMMENDATIONS

Monitoring Rationale

These subsequent recommendations are made to further assess the potential for environmental contamination migrating from waste disposal or spill areas located at AAC facilities. Several installations and individual sites were investigated during the Phase I IRP. Some of the installations and the disposal sites identified at them are located in remote areas of Alaska where the environmental setting is less complex. In such cases, it has been common practice to recommend generally basic, single effort sampling programs usually directed at a single medium (soil, surface water, ground water, etc.) to determine if contamination exists and/or has migrated from a disposal area. Such site-specific work is usually considered adequate to address all major concerns. If contamination is identified, the sampling program may be expanded to the further define the extent of migration. A few of the installations and their associated waste disposal sites are situated within complex environmental settings where sensitive ecosystems exist. In such cases, a more detailed type of investigation may be required to determine the presence of contamination and its potential impact on the receiving environment.

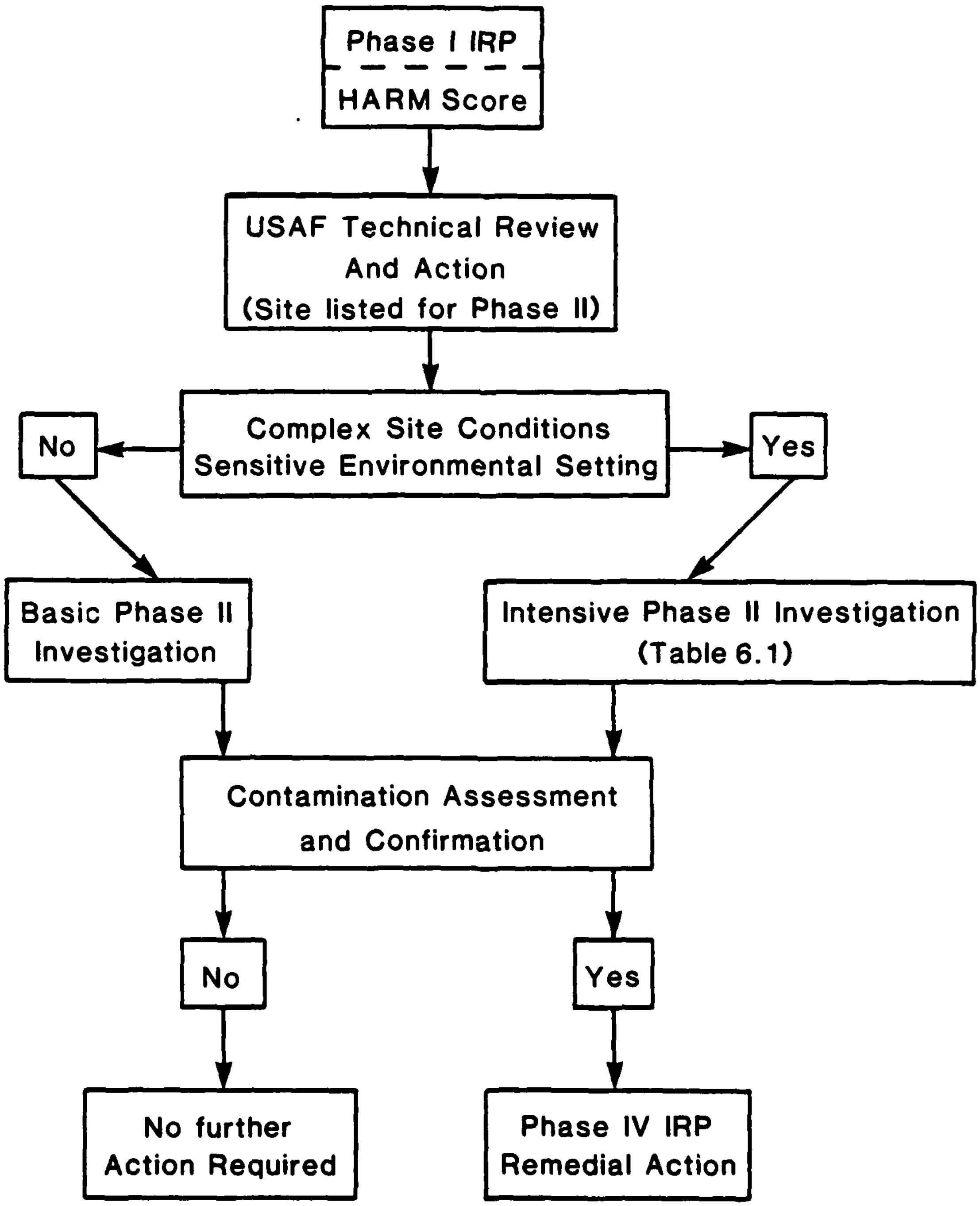
Figure 6.1 is a decision path which may be utilized to determine which level of Phase II environmental study should be employed at a specific site. Most of the sites recommended for further study under the Phase II IRP are considered to be relatively uncomplicated situations that can be addressed in an efficient manner by performing a basic investigation. Figure 6.2 is an example flow chart for a Phase II basic environmental investigation. The principal tasks include planning, site work, sampling and analysis, data review and report preparation. The basic environmental investigation is sufficiently flexible to function efficiently in a variety of situations.

A more intensive investigation may be required for sites located in complex physical or ecologic settings. Figure 6.3 is an example flow chart for an intensive investigation. The principal tasks include a site reconnaissance, preliminary and detailed site studies and report preparation. Table 6.1 summarizes the suggested tasks, subtasks, study elements, objectives and performance standards for an intensive Phase II IRP investigation. Not all of the subtasks and work elements listed in Table 6.1 may be required for each site recommended for an intensive investigation under Phase II IRP. Each study must be formulated to be capable of addressing the major concerns and conditions relative to each individual disposal site.

Site-Specific Conditions

The hydrogeologic conditions present at each waste disposal facility are entirely site-specific due to variations in geology, topography, land use modifications, etc. These natural conditions or man-made changes in the local environmental setting must be clearly understood in order to design an effective ground-water quality monitoring system. At present, these site-specific conditions existing at AAC waste disposal or hazardous material management facilities are relatively unknown. Soil test borings and temporary observation wells may be employed to obtain site-specific information. A systematic, more efficient and cost-effective approach would be to utilize geophysical techniques to obtain local subsurface information. Electrical resistivity (ER) and electromagnetic conductivity (EMC) are geophysical instruments that employ indirect measurement technologies to collect data describing subsurface material electrical properties. They respond to changes or contrasts in either the horizontal or vertical planes which may be

PHASE II INVESTIGATION DECISION PATH



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PROJECT FLOW CHART FOR RECOMMENDED PHASE II

BASIC ENVIRONMENTAL INVESTIGATION
ALASKAN AIR COMMAND FACILITIES

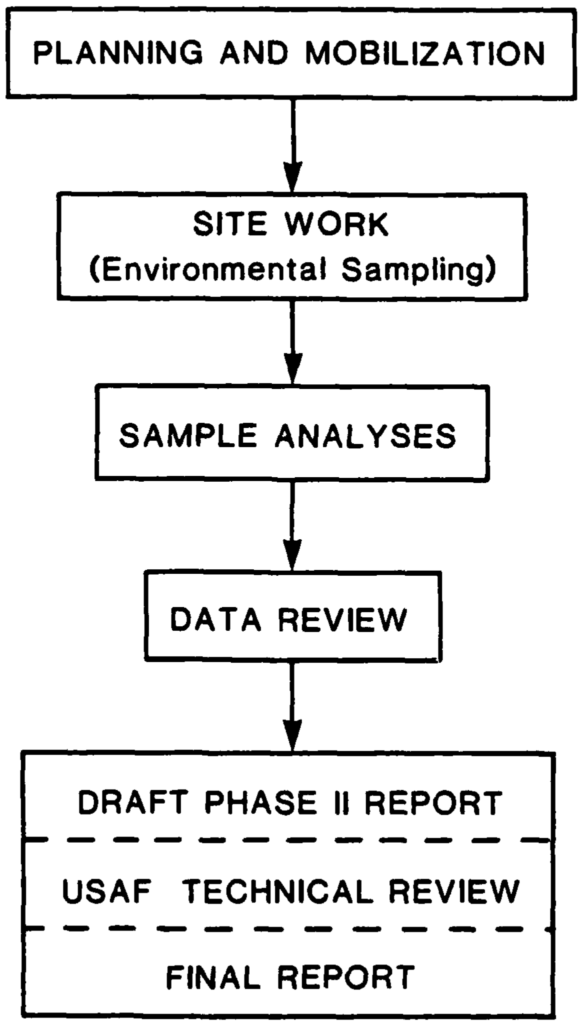

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FIGURE 6.3

PROJECT FLOW CHART FOR RECOMMENDED PHASE II

INTENSIVE ENVIRONMENTAL INVESTIGATION ALASKAN AIR COMMAND FACILITIES

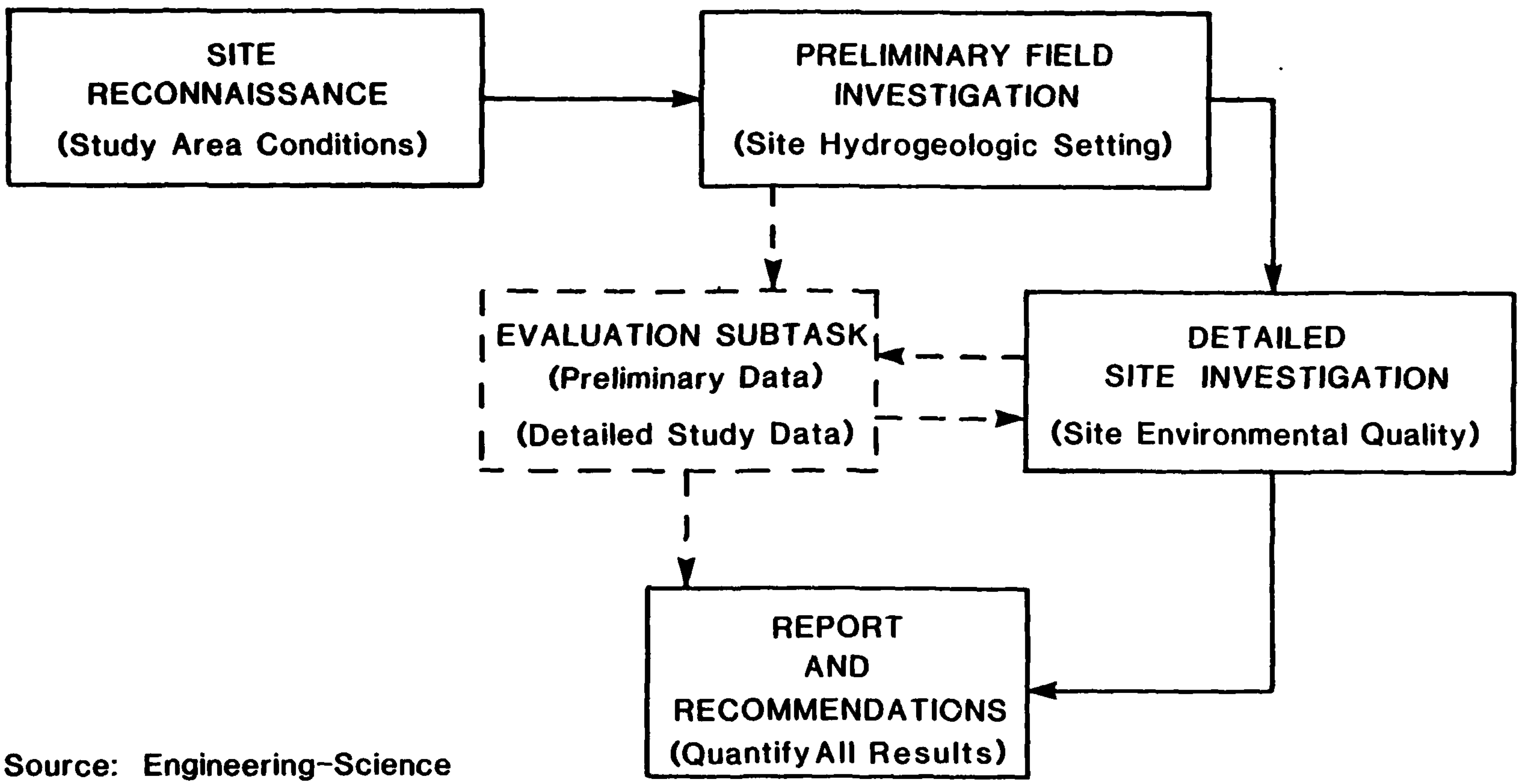

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TABLE 6.1
PROJECT TASK SUMMARY FOR RECOMMENDED PHASE II INTENSIVE ENVIRONMENTAL STUDY
ALASKAN AIR COMMAND FACILITIES

Task	Subtask	Element	Specific Objective	Performance Standard
1. Site reconnaissance	o Collect available information	o Review data obtain	o Project Planning	o Established by OEHL
		o Obtain site data	o Develop Project Work Plan	o Established by OEHL
	o Site inspection	o Examine topography, geomorphic setting, surface waters, etc.	o Determine access, logistical needs.	o Established by OEHL
	o Well inventory	o Area inspection	o Public health protection	o Established by OEHL
	o Biological inventory	o Map site ecosystem	o Identify vegetative stess areas.	o Established by OEHL
			o Identify endangered species,	o Established by OEHL
	o Site survey	o Map study area	o Establish horizontal control.	o State land survey requirements.
2. Preliminary Field Investigation	o Site characterization	o Standard test boring (50 ft. min)	o Obtain geologic samples; provide correlative data for geophysics	o ASTM D-1586-67, 1587-67 and ASTM D-2113-70.
		o Geophysical study (ER, MG, etc.)	o Identify aquifer(s), permafrost and contaminant zones.	o Applicable guidelines
		o Observation wells	o Identify aquifer of interest; monitor aquifer test, obtain water levels.	o Applicable guidelines
		o Preliminary ground water flow map.	o Formulate conceptual model	o Appropriate professional methods.
	o Identification testing	o Grain-size analyses	o Characterize site hydrogeologic units	o ASTM D-421 and 422
		o Atterberg limits		o ASTM D-424
		o Permeability		o ASTM STP-746
		o Other characterization tests.		o Applicable guidelines
	o Evaluate preliminary data obtained	o Review data	o Refine work plan	o Established by OEHL
3. Detailed Site Investigation	o Install monitoring system	o Monitoring wells	o Obtain water quality and aquifer parameter data	o Project work plan
		o Sample wells/analyze samples	o Obtain water quality data	o Appropriate protocols
	o Perform environmental sampling	o Surface soil sampling and analyses	o Characterize study area environmental quality.	o Project work plan
		o Shallow test borings-interval sampling and analyses		
		o Surface water and sediment, sampling and analyses		
	o Install test well	o Perform aquifer test	o Determine contaminant migration criteria; define aquifer parameters; refine conceptual model.	o Project work plan
	o Baseline data review	o Review data	o Refine work plan; perform additional sampling, as required.	o Project work plan
4. Report and Recommendations	o Prepare draft report	o Perform detailed data review; assemble all information.	o Provide review document	o Project work plan
	o Prepare final report	o Refine draft document	o Provide final document	o Established by OEHL

NOTE: This "typical" example is furnished to illustrate the intensive study. Not all of these tasks and subtasks would be required for every site under study.
ER: Electrical Resistivity
MG: Magnetometer

Source: Engineering-Science

correlated to direct sampling methods, such as test borings. Both methods may be utilized in shallow situations (less than 30 feet deep) if local geology permits, to determine stratigraphic changes, permafrost, depth to ground water, aquifer thickness and contaminated zones if sufficient contrast exists. ER may be employed in more complicated terrains or in situations where deep contamination is suspected. Wells may then be installed systematically, in zones selected by the geophysical techniques. This approach to monitoring program design significantly reduces both costs and schedules. The use of geophysical techniques at waste disposal facilities has been well documented in the technical literature (Benson, et al., 1984). The use and significance of geophysical techniques was demonstrated by USGS scientists at Tin City AFS in 1973 (Ackermann, 1974). A USEPA guidance manual describes the capabilities and limitations of electrical resistivity at waste disposal facilities and is applicable to the probable conditions that may be encountered at AAC facilities (USEPA, 1978). Other geophysical methodologies can be utilized for specialized purposes--for example, a metal detector may be used in shallow settings to locate buried ferrous materials and the magnetometer may be utilized to locate either buried objects or disturbed zones (backfilled trenches or pits) in shallow and deep settings.

Ground-water quality monitoring systems must be designed for the site-specific conditions existing at a waste disposal facility. Guidelines for well system design have been published in several USEPA reports. One report indicates that a few guidelines are applicable to conditions such as those noted at AAC facilities. For large areas/landfills, or for areas with multiple ground-water flow directions, more than the usual four wells (one upgradient and three downgradient, from RCRA, Subpart F, Section 265.91, "Ground-Water Monitoring System") may be required. Where multiple flow directions may exist beneath a site, geophysical methods should be utilized to guide well placement, both the physical location and the screened interval. In situations where the site is physically large or has an unusual geometry and therefore has a long downgradient dimension (the site border, which when sketched on a topographic map, appears to be drawn at a right angle to the principal direction of ground-water flow), the general rule is to install one

monitoring well for each 250 feet of downgradient frontage (USEPA, 1980). This well spacing is considered to be a maximum allowable interval between wells, assuming that local hydrogeologic conditions are reasonably uniform. Wells must be installed at closer intervals if the site subsurface conditions are determined to be complex. Wells installed for the purpose of detecting floating contaminants (such as POL) must be constructed so that the well screen always intercepts the water table, regardless of seasonal ground-water level fluctuations.

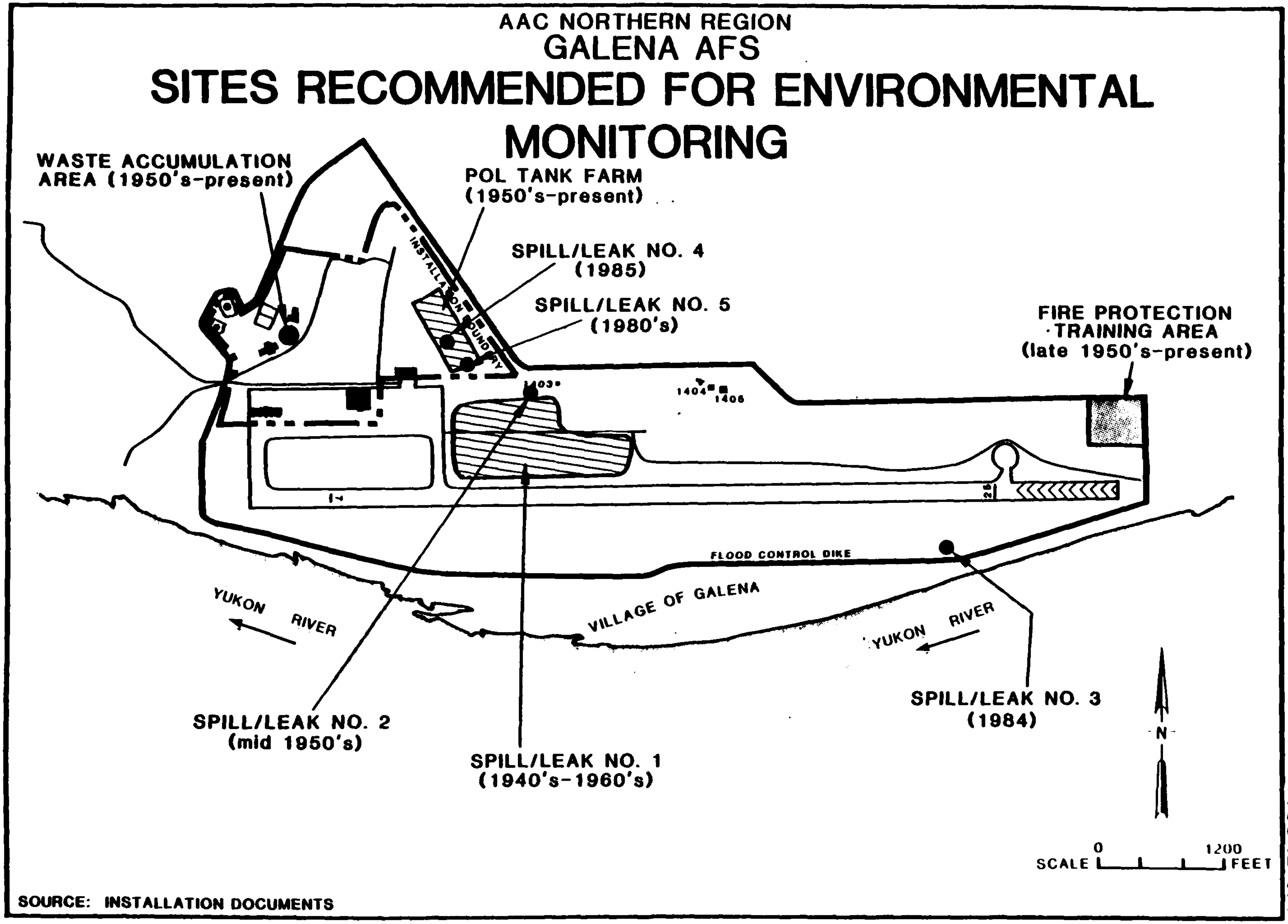
GALENA AFS

Galena AFS is located within the flood plain of the Yukon River. The installation is underlain by a considerable thickness of alluvium, poor to well-graded sand and gravel. The alluvium forms a shallow water-bearing unit in the study area and is also an aquifer of regional extent, supplying water to several communities including the adjacent village. Recharge occurs by precipitation infiltration or stream flow percolation. Discharge to local surface waters is likely. The community of Galena is probably located hydraulically downgradient with respect to Galena AFS. Ground water occurs in the alluvium at depths ranging from fourteen to thirty feet below grade. Permafrost is discontinuous in the Galena AFS study area. It is known to be absent near the course of the Yukon River (area occupied by the community of Galena) and discontinuous in the airfield area. Moderately thick permafrost (110 feet) is known to exist in the north section of the installation.

Galena AFS is a relatively large installation. Six sites have been identified for Phase II IRP follow-on studies (see Figure 6.4). Most of the sites are located in the west section of the base. These sites include: Waste Accumulation Area, POL Tank Farm and Spill/Leaks 1, 2, 4, and 5. These sites were evaluated, utilizing the Phase II Investigation Decision Path, Figure 6.1. The following key items were noted relative to the sites located in the west section of Galena AFS:

- Sites are confined to a relatively small area.
- The sites are located in the unsaturated portion of the regional aquifer (Yukon River alluvium).

FIGURE 6.4



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- Permafrost is discontinuous to moderately thick and may impact a site-specific study.
- POL contamination of shallow water-bearing zones and water supply wells at the airfield has been documented.
- A civilian population (community of Galena) is located at a point that may be hydraulically down-gradient with respect to some identified sites.

For these reasons, it has been determined that an intensive environmental study should be performed at this sites. The Phase II study area should include the four sites located in the west part of the installation and should be performed as a single investigation. The principal study objective should be the delineation of POL contaminant migration. A flow chart illustrating the intensive environmental study is presented as Figure 6.3. A summary of typical intensive study tasks, goals and performance standards is given in Table 6.1.

Two sites, the Fire Protection Training Area and Spill/Leak No. 3 are isolated at remote locations on the east part of the airfield. A study of the receiving environment relative to these two sites can be best served by performing basic studies (Figure 6.2) at the identified locations, emphasizing subsurface soils to determine vertical POL migration, if any.

The generalized recommendations for Phase II IRP investigations at Galena AFS are summarized in Table 6.2. Table 6.3 outlines the analytical tests for soil and water samples. Table 6.2 also recommends analyses for drinking water quality protection. Local wells may be at risk to installation contaminant migration.

CAMPION AFS

Campion AFS is situated on a high terrace above the Yukon River flood plain. It is underlain by a thick sequence of generally permeable alluvial sediments including s[illegible]t sand and gravel. The only definable shallow water-bearing unit present in the study area is thought to be the active zone above local permafrost. Permafrost in the area is reported to be moderately thick (377 feet). Suprapermafrost water, contained in permeable sediments during the spring-summer months, probably

TABLE 6.2
RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP AT GALENA AFS

Site No.	Site Name	HARM Score	Recommended Monitoring	Sample Analyses (Table 6.3)	Comments
1.	Waste Accumulation Area	80	Perform Intensive Study (Table 6.1).	C, D	Site Nos. 1-4 should be studied collectively, as a single area.
2.	Spill/Leak No. 1	75	Perform Intensive Study (Table 6.1).	A	All monitoring efforts (including surface soils, surface water and ground water) must be predicated upon local conditions.
3.	Spill/Leak No. 2	75	Perform Intensive Study (Table 6.1).	A	
4.	POL Tank Farm and Spill/Leak Nos. 4 and 5	69	Perform Intensive Study (Table 6.1).	A	
5.	Fire Protection Training Area	69	Perform a basic study: at least 3 test borings should be drilled within site limits plus one control outside, to a depth of 20 feet; perform sampling at 3 ft. depth intervals.	A	Additional borings may be required to assess contaminant migration extent.
6.	Spill/Leak No. 3	63	Perform a basic study: at least 3 test borings should be drilled within site limits plus one control outside, to a depth of 20 feet; perform sampling at 3 ft. depth intervals.	A	Additional borings may be required to assess contaminant migration extent.
-	Drinking Water Supply Wells	-	Sample and analyze.	G	Annual testing recommended.

Source: Engineering-Science

TABLE 6.3
RECOMMENDED LIST OF ANALYTICAL PARAMETERS
FOR PHASE II IRP

List A (Soil)	List B (Soil)	List C (Soil)
Oil and Grease [EPA 413.2] Volatile Organics [EPA 8010/8020]	PCBs [EPA 608]	Oil and Grease [EPA 413.2] Volatile Organics [EPA 8010/8020] Lead [EPA 239.1] PCBs [EPA 608]
List D (Water)	**List E (Water)**	**List F (Soil)**
pH [EPA 150.1] Oil and Grease [EPA 413.2] Volatile Organics [EPA601/602] Total Organic Carbon [EPA 415.1] Total Organic Halogens [EPA 450.1] Phenols [EPA 420.1] Lead [EPA 239.1] PCBs [EPA 608]	pH [EPA 150.1] Oil and Grease [413.2] Volatile Organics [EPA 601/602] Total Organic Carbon [EPA 415.1] Total Organic Halogens [EPA 450.1]	Oil and Grease [EPA 413.2] Volatile Organics [EPA 8010/8020] Lead [EPA 239.1]
List G (Water)		
Priority Pollutants (excluding Pesticides, and Asbestos) [EPA 624 and 625]		

NOTE: Referenced in brackets are the EPA Analytical Methods

Source: Engineering-Science

discharges to the Yukon River west of the installation, or the wetlands to the east. Installation wells obtain water from a point below permafrost. Ground water levels measured in these wells are 263.7 and 272.1 feet below grade.

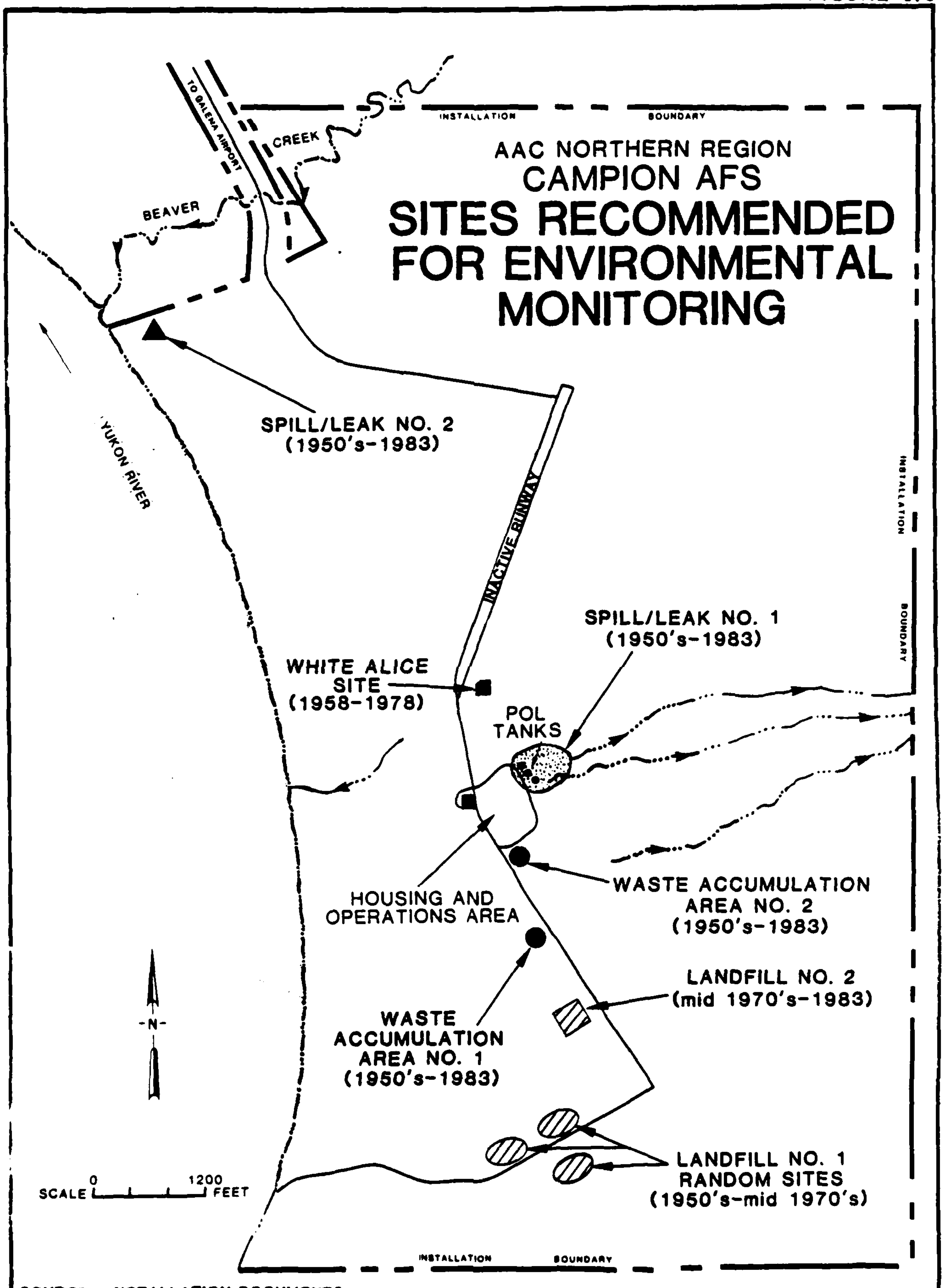
Campion AFS is an inactive installation which occupies a relatively large land area. Seven sites have been identified for Phase II IRP investigation (Figure 6.5). The sites are widely distributed throughout the installation. The sites include Landfill Nos. 1 and 2, Spill Leak Nos. 1 and 2, Waste Accummulation Areas, Nos. 1 and 2 and the former White Alice Communications System site. They were evaluated, utilizing the Phase II Investigation Decision Path, Figure 6.1. It is concluded that Phase II basic environmental investigations should be performed at the seven sites. An example flow chart for the recommended studies is presented as Figure 6.2. The recommended studies should focus on soil and groundwater quality. The generalized recommendations for Phase II IRP investigations at Campion AFS are summarized in Table 6.4.

CAPE LISBURNE AFS

The geology of the Cape Lisburne AFS Lower Camp and airfield areas is dominated by highly permeable talus and alluvial fan deposits composed of clay, silt, sand, gravel, cobbles and large boulders. A moderately well sorted alluvium has been deposited in the channel of Selin Creek. These deposits are considered to be highly permeable and contain ground water at depths generally less than thirty feet below grade. The Lower Camp area is underlain by thick, continuous permafrost. Shallow ground water occurs in the active zone above the permafrost layer during the spring and summer period. The shallow ground water is discharged to the Chukchi Sea.

The Cape Lisburne Upper Camp geology consists of thin gravelly residuum overlying bedrock at shallow depths. The existence of ground water, water levels, flow directions, etc., are unknown. If ground water is present in the Upper Camp area, it is likely contained in the fractures, fissures, faults, bedding planes, or other secondary openings in local bedrock. The permafrost conditions present at the Upper Camp are unknown.

FIGURE 6.5



SOURCE: INSTALLATION DOCUMENTS

TABLE 6.4
RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP AT CAMPION AFS

Site No.	Site Name	HARM Score	Recommended Monitoring	Sample Analyses (Table 6.3)	Comments
1.	Landfill No. 1	59	Perform a basic study: geophysical study to determine extent of contamination and to aid in placement of wells; install suprapermafrost wells. Sample one background well and one downgradient well for each 250 ft. of downgradient frontage.	D	If sampling indicates contamination, continue monitoring. Additional wells and soil borings may be necessary to assess extent of contamination.
2.	Spill/Leak No. 1	56	Perform a basic study: at least three test borings should be taken within site limits; perform sampling up to 20 ft. below grade and at three ft. vertical intervals.	A	If sampling indicates contamination, continue monitoring. Additional soil borings may be necessary to assess extent of contamination.
3.	Waste Accumulation Area No. 2	56	Perform a basic study: at least three test borings should be taken within site limits; perform sampling up to 20 ft. below grade and at three ft. vertical intervals.	C	If sampling indicates contamination, continue monitoring. Additional soil borings may be necessary to assess extent of contamination.
4.	Landfill No. 2	56	Perform a basic study: geophysical study to determine extent of contamination and to aid in placement of wells; install suprapermafrost wells. Sample one background well and one downgradient well for each 250 ft. of downgradient frontage.	D	If sampling indicates contamination, continue monitoring. Additional wells and soil borings may be necessary to assess extent of contamination.
5.	Spill/Leak No. 2	54	Perform a basic study: at least three test borings should be taken within site limits; perform sampling up to 20 ft. below grade and at three ft. vertical intervals.	A	If sampling indicates contamination, continue monitoring. Additional soil borings may be necessary to assess extent of contamination.
6.	Waste Accumulation Area No. 1	54	Perform a basic study: at least three test borings should be taken within site limits; perform sampling up to 20 ft. below grade and at three ft. vertical intervals.	C	If sampling indicates contamination, continue monitoring. Additional soil borings may be necessary to assess extent of contamination.
7.	White Alice Site	49	Perform a basic study: drill 5 ft. deep borings on a 5 by 5 ft. square grid pattern acrosss the site. Sample at 1-2 ft. and 4-5 ft. depths.	B	Additional borings may be required to define the extent of contamination.

Source: Engineering-Science

Six sites at Cape Lisburne AFS warrant further Phase II study (refer to Figure 6.6). The sites were evaluated using the Phase II Investigation Decision Path (Figure 6.1). A basic Phase II investigation is recommended (Figures 6.2) for the six sites at Cape Lisburne AFS. The monitoring program for these sites is summarized in Table 6.5. Annual sampling and analysis of water from the installation water supply is also recommended.

The Phase II monitoring program at Cape Lisburne AFS emphasizes soil sampling in the vicinity of sites and sampling of surface waters that may receive contaminants.

FORT YUKON AFS

Fort Yukon AFS is set on a low terrace of the Yukon Flats area, overlooking Yllota Slough. Local geology consists of Yukon River Valley alluvial silt, sand and gravel sediments. Ground water is contained in the alluvium at generally shallow depths ranging from twenty to thirty feet below grade. The alluvium forms an aquifer of regional significance. Both the installation and the nearby Town of Fort Yukon derive their water supplies from shallow alluvium. The Town is located hydraulically down gradient with respect to the installation. Permafrost is generally absent along the river course. Permafrost is present at points set back from the river and ranges in thickness form 18 to 390 feet. Suprapermafrost water likely discharges to local surface waters during the spring-summer months and freezes during the winter period. Fort Yukon AFS is located in the Yukon Flats National Wildlife Refuge.

Five disposal sites have been identified at Fort Yukon AFS for further study in the Phase II IRP (Figure 6.7). These sites were evaluated utilizing the Phase II Investigation Decision Path, Figure 6.1. The following key items were noted relative to the subject sites:

- o Four of the identified sites are located within a relatively small section of the installation.
- o Fort Yukon AFS is underlain by an aquifer of regional significance (Yukon River alluvium).
- o Fort Yukon AFS is located in a sensitive environment, the Yukon Flats National Wildlife Refuge.

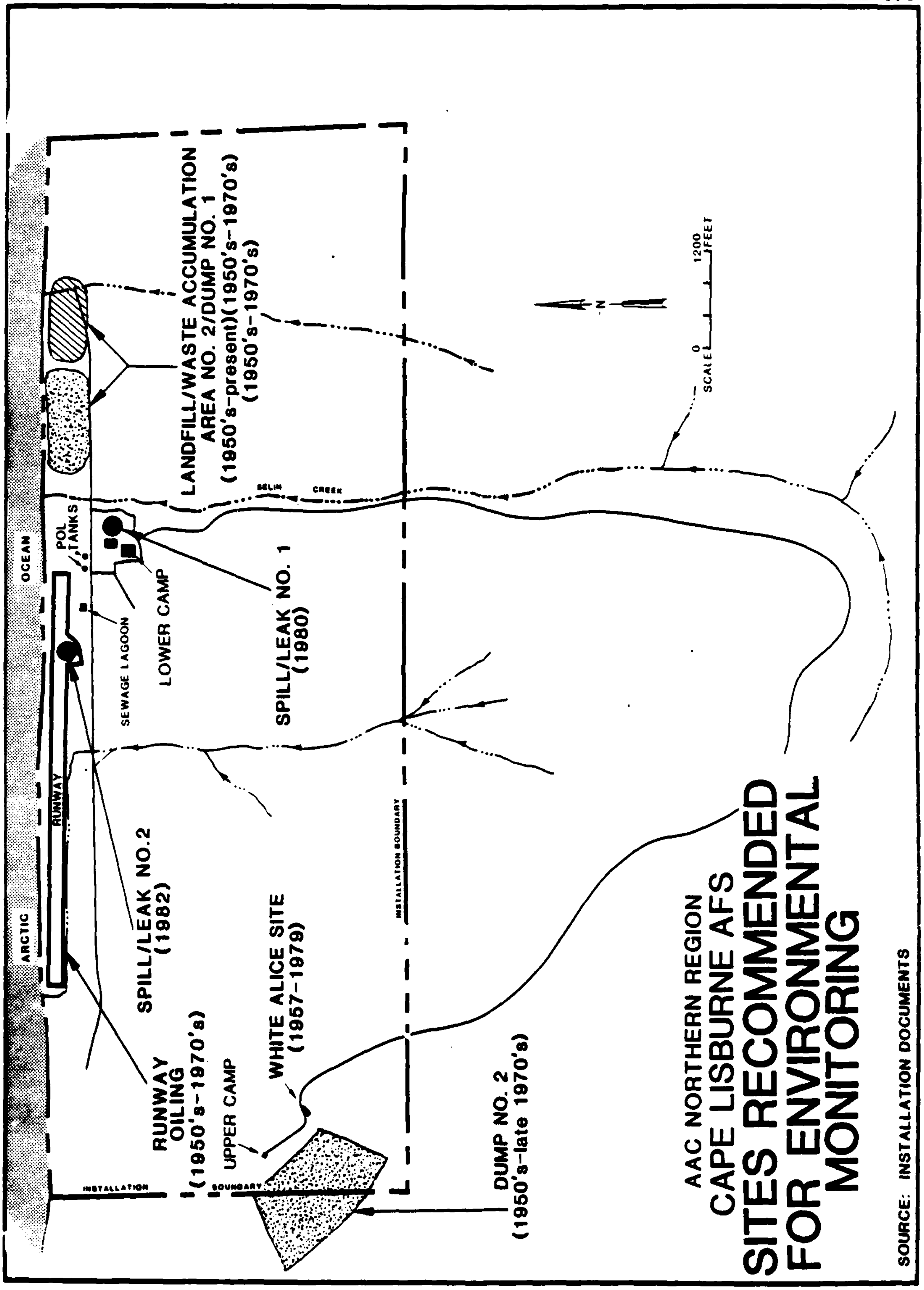


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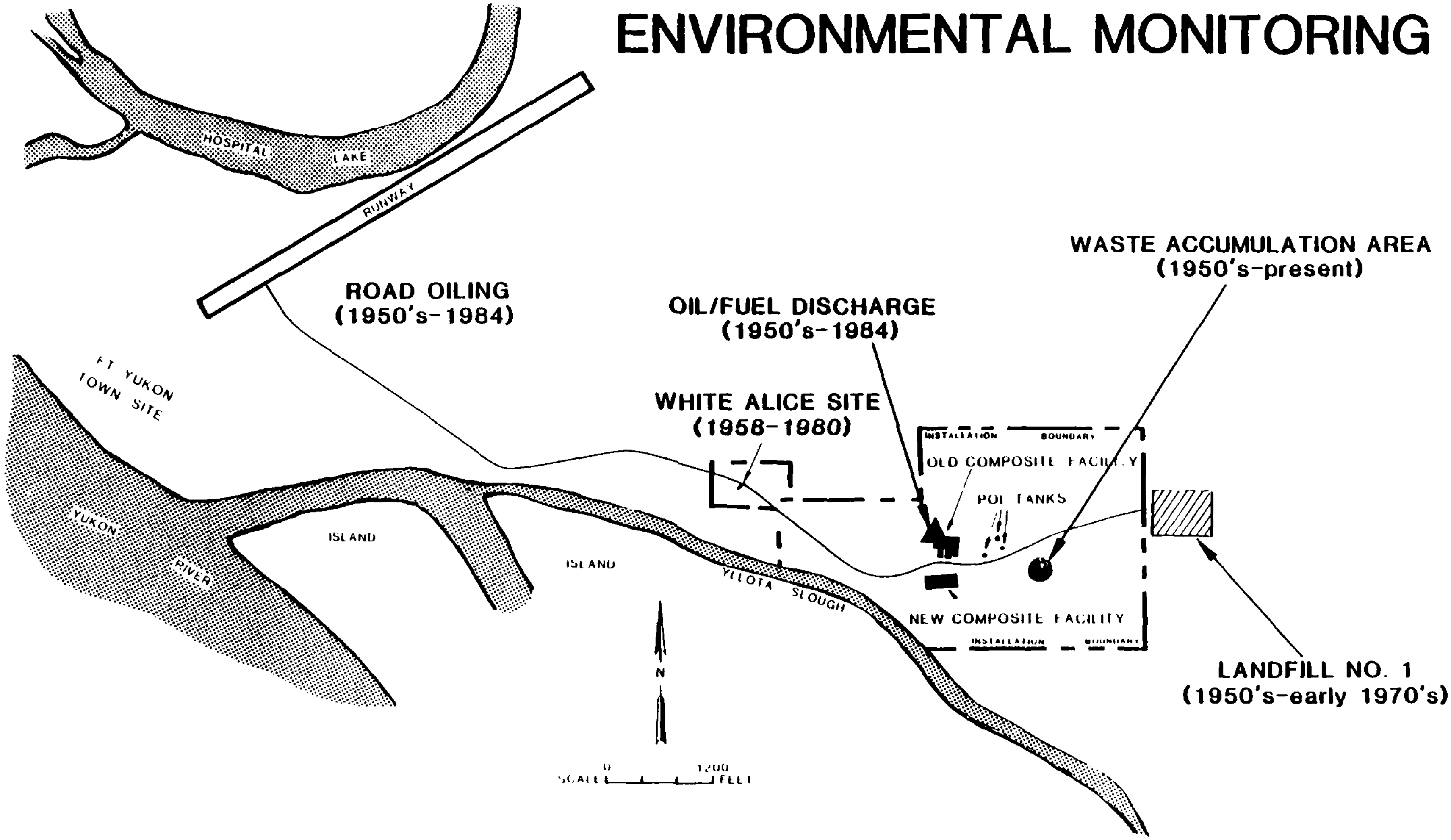
TABLE 6.5
RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP AT CAPE LISBURNE AFS

Site No.	Site Name*	HARM Score	Recommended Monitoring	Sample Analyses (Table 6.3)	Comments
1	Spill/Leak No. 1 (LC)	71	Perform a basic study: advance 3 test borings in vicinity of the spill and 1 control boring to a depth of 20 ft. Perform sampling at 3 ft. depth intervals. Collect an upstream and two down-stream surface water and sediment samples from Selin Creek.	A, E	Additional borings and/or surface water and sediment sample may be required to define extent of contamination.
2	Dump No. 2 (UC)	67	Perform a basic study: collect at least 3 surface water and sediment samples from the tributary stream to Kay Creek. Obtain 2 soil samples of depths of 1-2 ft. and 4-5 ft. at toe of slope, at 2 other locations where disposal has taken place and at a control location outside the area.	D, C	Additional borings may be required to define extent of contamination.
3	Spill/Leak No. 3 (LC)	66	Perform a basic study: advance 3 test borings in vicinity of the spill and 1 control boring to a depth of 20 ft. Perform sampling at 3 ft. depth intervals.	F	Additional borings may be required to define extent of contamination.
4	Landfill & Waste Accumulation Area No. 2/ Dump No. 1	62	Perform a basic study: collect 3 surface water and sediment from unnamed creek.	D, C	Additional samples may be required if contamination is found. Soil borings may be required to determine extent of contamination.
5	Runway Oiling (LC)	52	Perform a basic study: test borings should be drilled along runway centerline at 1,000 ft. intervals. Sample at 1-2 ft. and 4-5 ft. depths. Obtain control soil samples opposite each runway sample.	C	Additional borings may be required to define extent of contamination.
6	White Alice Site (UC)	49	Perform a basic study: drill 5 ft. deep borings on 5 ft. by 5 ft. square grid pattern across site. Sample at 1-2 ft. and 4-5 ft. depths.	B	Additional borings may be required to define extent of contamination.
-	Water Supply Gallery	-	Sample and Analyze.	G	Annual testing recommended.

* LC - Lower Camp; UC = Upper Camp

FIGURE 6.7

AAC NORTHERN REGION
FORT YUKON AFS
SITES RECOMMENDED FOR ENVIRONMENTAL MONITORING



SOURCE: INSTALLATION DOCUMENTS

- o Both the Fort Yukon AFS and the adjacent Town of Fort Yukon water supply collection systems are at risk to potential contaminant migration emanating from the installation.

For these reasons, it has been determined that an intensive environmental study should be performed at Fort Yukon AFS for all the sites located there: Road Oiling, Waste Accumulation Area, Landfill No. 1 and the Power Plant Oil Discharge. A flow chart illustrating the essential tasks of an intensive environmental assessment is presented as Figure 6.3. A summary of typical intensive assessment tasks, goals and performance standards is listed in Table 6.1.

The remaining disposal area, the White Alice site, has been selected for individual study. An investigation of the receiving environment proximate to this facility can best be served by conducting a basic study (Figure 6.2). The study should emphasize soil sampling and analyses to detect contaminant migration.

The generalized recommendations for Phase II IRP investigations at Fort Yukon AFS are summarized in Table 6.6. Also included in Table 6.6 are recommendations for the sampling and analyses of installation and town drinking water supply collection systems. Both installation and Town of Fort Yukon drinking water collection systems are at severe risk to potential contaminant migration.

INDIAN MOUNTAIN AFS

The hydrogeology of the Indian Mountain AFS Lower Camp consists of alluvial deposits associated with the development of the Indian River and its tributaries. The alluvium includes stratified silt, sand and gravel deposits which typically contain ground water at relatively shallow depths below ground surface. These materials are considered to be permeable during the spring-summer season, are recharged by precipitation infiltration and likely discharge to local surface waters (downgradient). Lower Camp permafrost conditions are uncertain.

The hydrogeology of the Indian Mountain AFS Upper Camp consists of thin residual sand, gravel and cobble deposits overlying bedrock at shallow depths. The northeast and north slopes of Indian Mountain are overlain by glacial materials. All of the surficial materials present

TABLE 6.6
RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP AT FORT YUKON AFS

Site No.	Site Name	HARM Score	Recommended Monitoring	Sample Analyses (Table 6.3)	Comments
1	Road Oiling	61	Perform Intensive Study (Table 6.1)	C, E	Sites 1, 2, 3 and 4 should be studied collectively as a single area. All monitoring (soil, surface water and ground water) must be based on local site-specific conditions.
2	Waste Accumulation Area	59	Perform Intensive Study (Table 6.1)	C, E	
3	Landfill No. 1	58	Perform Intensive Study (Table 6.1)	C, E	
4	Oil Discharge Beneath	56	Perform Intensive Study (Table 6.1)	C, E	
5	White Alice Site	54	Perform a basic study: drill 5-ft. deep borings on a 5 by 5 ft. square grid across the site. Sample at 1-2 ft. and 4-5 ft. depth increments.	B	Additional borings may be required to determine the extent of contamination.
	Drinking Water Collection Systems (Installation and Town)		Sample and analyze and advise appropriate state authority	G	Annual testing recommended.

Source: Engineering-Science

on Indian Mountain likely exhibit high permeabilities at least during the spring-summer melt and thaw cycle. Local shallow aquifers are recharged by precipitation infiltration or runoff percolation during the warm months. The shallow aquifer discharges flow downslope which may emerge as springs or as baseflow to local streams, as indicated by the numerous POL spill incidents during past years. Permafrost may be present in the Upper Camp study area, but its depth and distribution is undefined.

Indian Mountain AFS is a relatively large installation. Eleven potential contamination sites have been identified for Phase II IRP follow-on studies (Figure 6.8). Eight sites are situated at the Lower Camp and three sites are located at the Upper Camp. These sites were evaluated, utilizing the Phase II Investigation Decision Path, Figure 6.1. The following key items were noted relative to the subject sites:

Upper Camp

- Sites are confined to a small mountainous area.
- Sites are located on a thin talus or residual over burden, underlain by severely fractured bedrock.
- The fractured bedrock corresponds to the local uppermost aquifer. Flow characteristics are unknown.
- POL contamination of shallow geologic units has been documented, but is undefined.
- Permafrost is probably present, but is undefined.

Lower Camp

- Several sites are confined to a relatively small area.
- All sites are located on permable talus and/or alluvium of Utopia Creek and the Indian River.
- The talus/alluvium forms the local shallow aquifer.
- The sites are set on its recharge zone.
- Shallow aquifer characteristics are uncertain.
- The Lower Camp obtains its water supply from the shallow aquifer.
- Permafrost conditions are unknown.

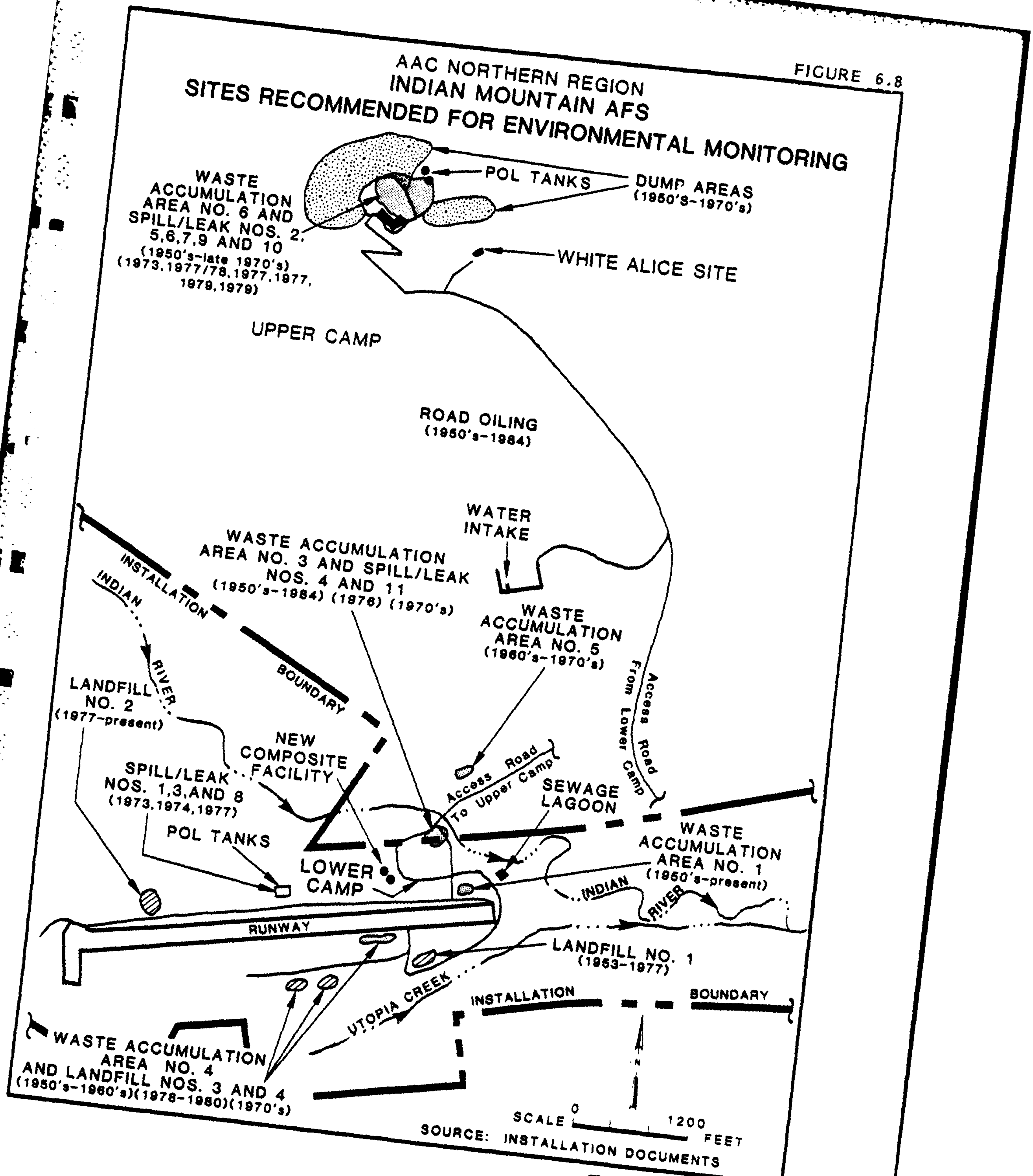


FIGURE 6.8
AAC NORTHERN REGION
INDIAN MOUNTAIN AFS
SITES RECOMMENDED FOR ENVIRONMENTAL MONITORING
WASTE ACCUMULATION AREA NO. 6 AND SPILL/LEAK NOS. 2, 5,6,7,9 AND 10
(1950's-late 1970's)
(1973,1977/78,1977,1977, 1979,1979)
POL TANKS
DUMP AREAS
(1950's-1970's)
WHITE ALICE SITE
UPPER CAMP
ROAD OILING
(1950's-1984)
WATER INTAKE
WASTE ACCUMULATION AREA NO. 3 AND SPILL/LEAK NOS. 4 AND 11
(1950's-1984) (1976) (1970's)
WASTE ACCUMULATION AREA NO. 5
(1960's-1970's)
INSTALLATION BOUNDARY
INDIAN RIVER
LANDFILL NO. 2
(1977-present)
NEW COMPOSITE FACILITY
SPILL/LEAK NOS. 1,3,AND 8
(1973,1974,1977)
Access Road To Upper Camp
Access Road From Lower Camp
SEWAGE LAGOON
POL TANKS
LOWER CAMP
WASTE ACCUMULATION AREA NO. 1
(1950's-present)
RUNWAY
LANDFILL NO. 1
(1953-1977)
UTOPIA CREEK
INSTALLATION BOUNDARY
WASTE ACCUMULATION AREA NO. 4 AND LANDFILL NOS. 3 AND 4
(1950's-1960's)(1978-1980)(1970's)
N
SCALE 0 1200 FEET
SOURCE: INSTALLATION DOCUMENTS

For these above reasons, it has been determined that two intensive environmental studies should be performed. An intensive study at the Upper Camp would be for two sites located there and a similar study at the Lower Camp would be for seven sites. A flow chart illustrating the intensive environmental study is shown as Figure 6.3. A summary of typical intensive study tasks, goals and performance standards is listed in Table 6.1.

Two sites, the White Alice Communications System Facility and the Road Oiling areas have been selected for individual investigations. A study of the receiving environment relative to these sites can best be served by performing a basic study (Figure 6.2) at the identified locations, emphasizing subsurface soils to detect contaminant migration.

The generalized recommendations for Phase II IRP investigations at Indian Mountain AFS are summarized in Table 6.7. Also included in Table 6.7 are specific analyses for drinking water quality protection. Installation drinking water collection systems are at risk to potential contaminant migration.

KOTZEBUE AFS

The hydrogeology of the Kotzebue AFS study area consists of glacial moraine deposits overlain locally by sandy beach deposits. Suprapermafrost ground water occurs in the shallow materials during the spring-summer months, but freezes during the winter period. The permafrost layer is reported to be some 238 feet thick in the study area. Brackish ground water occurs beneath the permafrost zone. These sediments are considered to be permeable.

Phase II investigations are warranted at three sites at Kotzebue LRR (Figure 6.9). These three sites are: Spill/Leak Nos. 1, 2, and 3, Waste Accumulation Area No. 1 and Road Oiling. These sites were evaluated using the Phase II Investigation Decision Path, Figure 6.1. A basic Phase II investigation (Figure 6.2) is recommended for the sites at Kotzebue AFS.

The most complex site at Kotzebue AFS is Spill/Leak Nos. 1, 2, and 3. The site includes the vicinity of the composite facility where contaminated soils are present and where contaminants have migrated to the suprapermafrost zone. The Phase II monitoring program includes

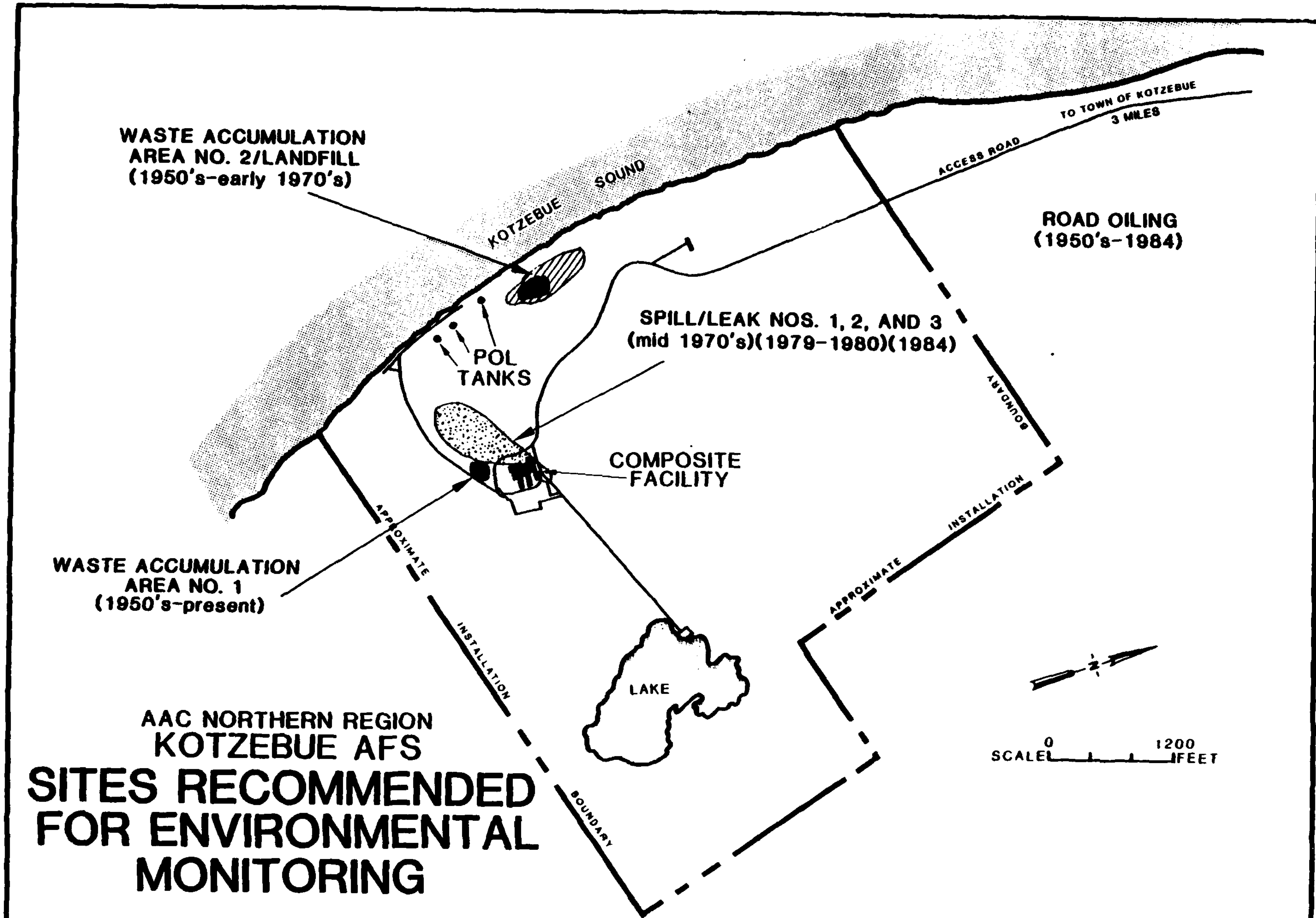
TABLE 6.7

RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP AT INDIAN MOUNTAIN AFS

Site No.*	Site Name	HARM Score	Recommended Monitoring	Sample Analyses (Table 6.3)	Comments
UPPER CAMP					
3.	Waste Accumulation Area No. 6 Spill/Leak Nos. 2, 5, 6, 7, 9 and 10	67	Perform Intensive Study (Table 6.1).	C,D	Sites 3 and 9 should be studied collectively as a single area. All monitoring (soil, surface water, ground water) efforts must be based on local conditions. Additional borings may be required.
9.	Dump Areas	64	Perform Intensive Study (Table 6.1).	C,D	
11.	White Alice Site	51	Perform a basic study: drill 5 ft. deep borings on a 5 by 5 square grid pattern across the site. Sample at 1-2 ft. and 4-5 ft. depths.	B	
--	Drinking Water Supply Catchment	--	Sample and analyze.	G	Annual testing recommended.
LOWER CAMP					
1.	Spill/Leak Nos. 1,3, and 8	77	Perform Intensive Study (Table 6.1).	C,D	Sites 1, 2, 4, 5, 6, 7, and 8 should be studied collectively, as a single area. All monitoring (soil, surface water, ground water) efforts must be based on local conditions.
2.	Waste Accumulation Area No. 4 and Landfill Nos. 3 and 4	71	Perform Intensive Study (Table 6.1).	C,D	
4.	Waste Accumulation Area No. 1	65	Perform Intensive Study (Table 6.1).	C,D	
5.	Waste Accumulation Area No. 3 and Spill/Leak Nos. 4 and 11	65	Perform Intensive Study (Table 6.1).	C,D	
6.	Waste Accumulation Area No. 5	65	Perform Intensive Study (Table 6.1).	C,D	
7.	Landfill No. 1	65	Perform Intensive Study (Table 6.1).	C,D	
8.	Landfill No. 2	62	Perform Intensive Study (Table 6.1).	C,D	
10.	Road Oiling	65	Perform a basic study: drill 5 ft. deep borings at 2500-ft. intervals along road centerline. Sample at 1-2 ft. and 4-5 ft. depths. Obtain control samples along ROW opposite each road sample.	C	Additional borings may be required.
--	Drinking Water Supply Gallery	--	Sample and analyze.	G	Annual testing recommended.

*Note: Sites are listed out of order to facilitate the monitoring recommendations discussion.
Source: Engineering-Science

FIGURE 6.9



AAC NORTHERN REGION
KOTZEBUE AFS
SITES RECOMMENDED
FOR ENVIRONMENTAL
MONITORING

SOURCE: INSTALLATION DOCUMENTS

ES ENGINEERING-SCIENCE

samples from test borings in the vicinity of the composite facility and geophysical studies and ground water monitoring program southwest of the composite facility to assess the extent of contaminant migration. The depth of the monitoring wells and the screened interval will be dependent on the thickness of the suprapermafrost zone. However, wells should be screened and samples should be collected in a manner such that contaminants floating near the surface or on top of the seasonal groundwater table may be detected.

The Phase II recommendations for the other two sites are collection of soil samples from test borings advanced in the vicinity of the site. A further general recommendation is the collection and analysis of a sample from the lake used for the installation water supply. The Phase II recommendations for Kotzebue AFS are summarized in Table 6.8.

MURPHY DOME AFS

The hydrogeology of the Murphy Dome AFS study area is dominated by thin residual deposits overlying bedrock at shallow depths on the upland sections. The lowlands and stream valleys are underlain by relatively thick alluvial sequences. Ground water occurs in the upland residuum at least seasonally. Recharge occurs principally by precipitation infiltration through the very permeable surface residual layer. Discharge is directed downslope, probably following topography to local surface waters. Permafrost is reported to be discontinuous in the study area and may be absent locally.

Murphy Dome AFS has seven sites recommended for follow-on Phase II investigations (Figure 6.10). Most of the sites are located near the housing and operations area. Landfill No. 2, however, is located off the installation approximately six miles away adjacent to the access road. An evaluation of sites and their environmental setting was undertaken using the approach outlined in Figure 6.1. It is concluded that the Murphy Dome sites can be accomodated by a basic Phase II program (Figure 6.2). Emphasis should be placed upon characterizing subsurface soils to assess the presence of contamination and the potential extent of migration. The recommendations for Phase II IRP at Murphy Dome are presented in Table 6.9.

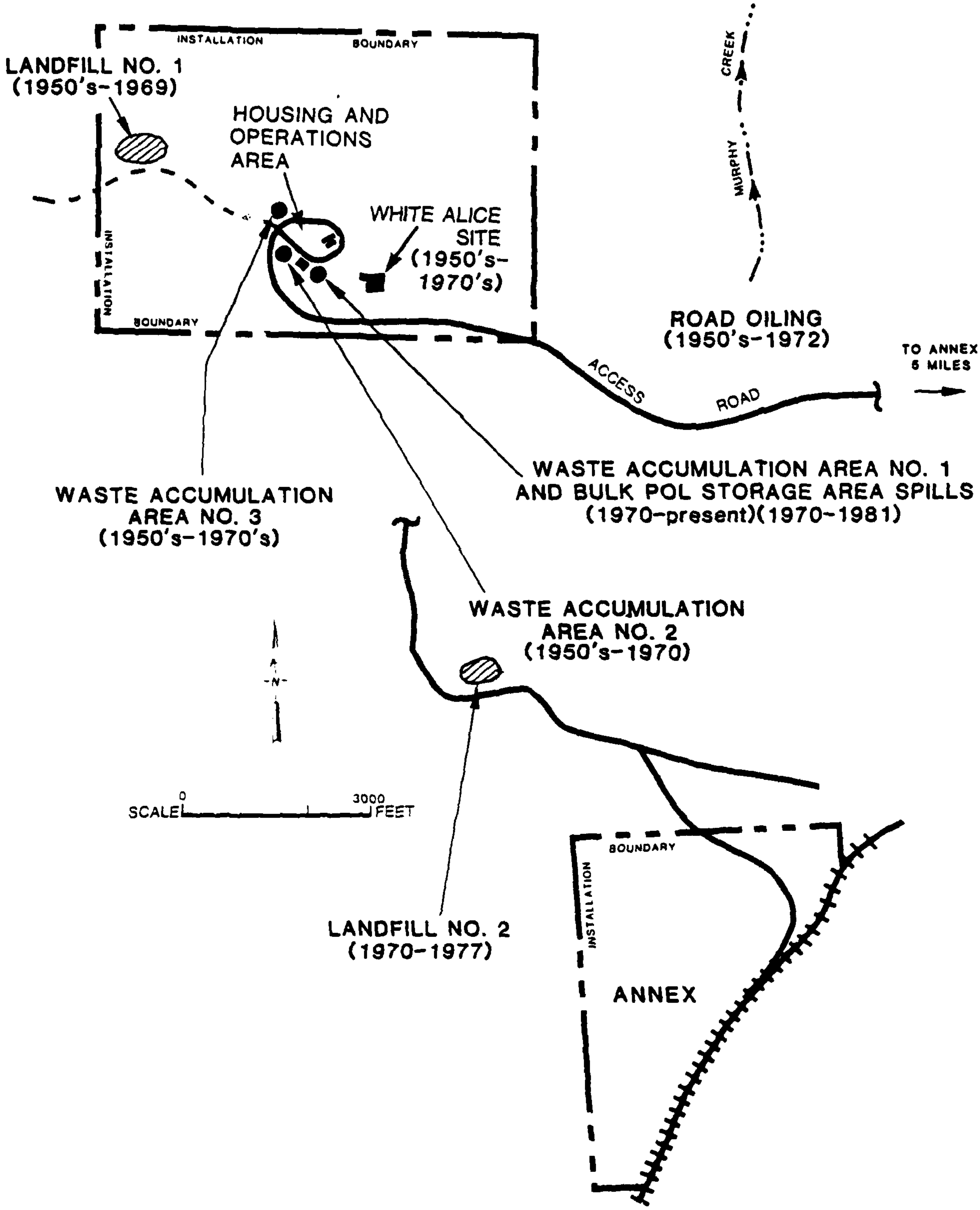
TABLE 6.8
RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP AT KOTZEBUE AFS

Site No.	Site Name	HARM Score	Recommended Monitoring	Sample Analyses (Table 6.3)	Comments
1	Spill/Leak Nos. 1, 2, & 3	75	Perform a basic study: geophysical study to determine extent of contamination and to aid in placement of monitoring wells. Install and sample suprapermafrost wells. Advance test borings near composite facility to depth of 20 ft. Sample and analyze soils at 3 ft. depth intervals to determine extent of contamination.	A, E	If sampling indicates contamination continue monitoring. Additional wells and soil borings may be necessary to assess extent of contamination.
2	Road Oiling	51	Perform a basic study: test borings should be drilled along the road centerline at 2,500 ft. intervals. Sample at 1-2 ft. and 4-5 ft. depths. Obtain several control samples along ROW opposite each road sample.	C	Additional borings may be required to define extent of contamination.
3	Waste Accumulation Area No. 1	49	Perform a basic study: at least 3 test borings should be drilled within site limits, to a depth of 20 ft.; perform sampling at 3 ft. depth intervals.	C	Additional borings may be required to define extent of contamination.
-	Drinking Water Supply Lake	-	Sample and Analyze	G	Annual testing recommended.

Source: *Engineering-Science*

FIGURE 6.10

AAC NORTHERN REGION
MURPHY DOME AFS
SITES RECOMMENDED FOR ENVIRONMENTAL MONITORING



SOURCE: INSTALLATION DOCUMENTS

TABLE 6.9

RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP AT MURPHY DOME AFS

Site No.	Site Name	HARM Score	Recommended Monitoring	Sample Analyses (Table 6.3)	Comments
1	Road Oiling	57	Perform a basic study: drill 5 ft. deep borings at 2500 ft. intervals along centerline. Sample at 1-2 ft. and 4-5 ft. depths. Obtain control samples along ROW opposite each road sample.	C	Additional borings may be required.
2	Landfill No. 2	55	Perform a basic study: conduct geophysical survey to locate borings/wells. Drill borings around site and establish monitoring wells in potential seasonally perched water at site; locate one well upgradient and three downgradient. Sample unnamed tributary of Goldstream Creek.	D	Obtain 20 ft. deep borings around site and analyze soil at 3 ft. intervals (List C, Table 6.3) if ground water is not shallow at site.
3	Waste Accumulation Area No. 1 and Bulk POL Storage Area Spills	50	Perform a basic study: drill 5-10 ft. deep borings; along downgradient edge of POL berm, 1 in the accumulation area and 1 control outside the area. Obtain 2-3 soil samples per boring.	C	If contamination is found, additional borings may be needed to determine the extent of migration.
4	Waste Accumulation Area No. 2	50	Perform a basic study: drill 5-10 ft. deep borings at 2 locations in the site area and 1 control outside; obtain 2-3 soil samples per boring.	C	If contamination is found, additional borings may be needed to determine the extent of migration.
5	Waste Accumulation Area No. 3	50	Perform a basic study: drill 5-10 ft. deep borings at 2 locations in the site area and 1 control outside; obtain 2-3 soil samples per boring.	C	If contamination is found, additional borings may be needed to determine the extent of migration.
6	Landfill No. 1	50	Perform a basic study: conduct geophysical survey to locate borings/wells. Drill borings around site and establish monitoring wells in potential seasonally perched water at site; locate one well upgradient and three downgradient.	D	Obtain 20 ft. deep borings around site and analyze soil at 3 ft. intervals (List C, Table 6.3) if ground water is not shallow at site.
7	White Alice Site	50	Perform a basic study: drill 5-ft. deep borings on a 5 by 5 ft. square grid pattern in suspected disposal areas at the site. Sample 1-2 ft. and 4-5 ft. depths.	B	Additional borings may be required to define the extent of contamination.

TIN CITY AFS

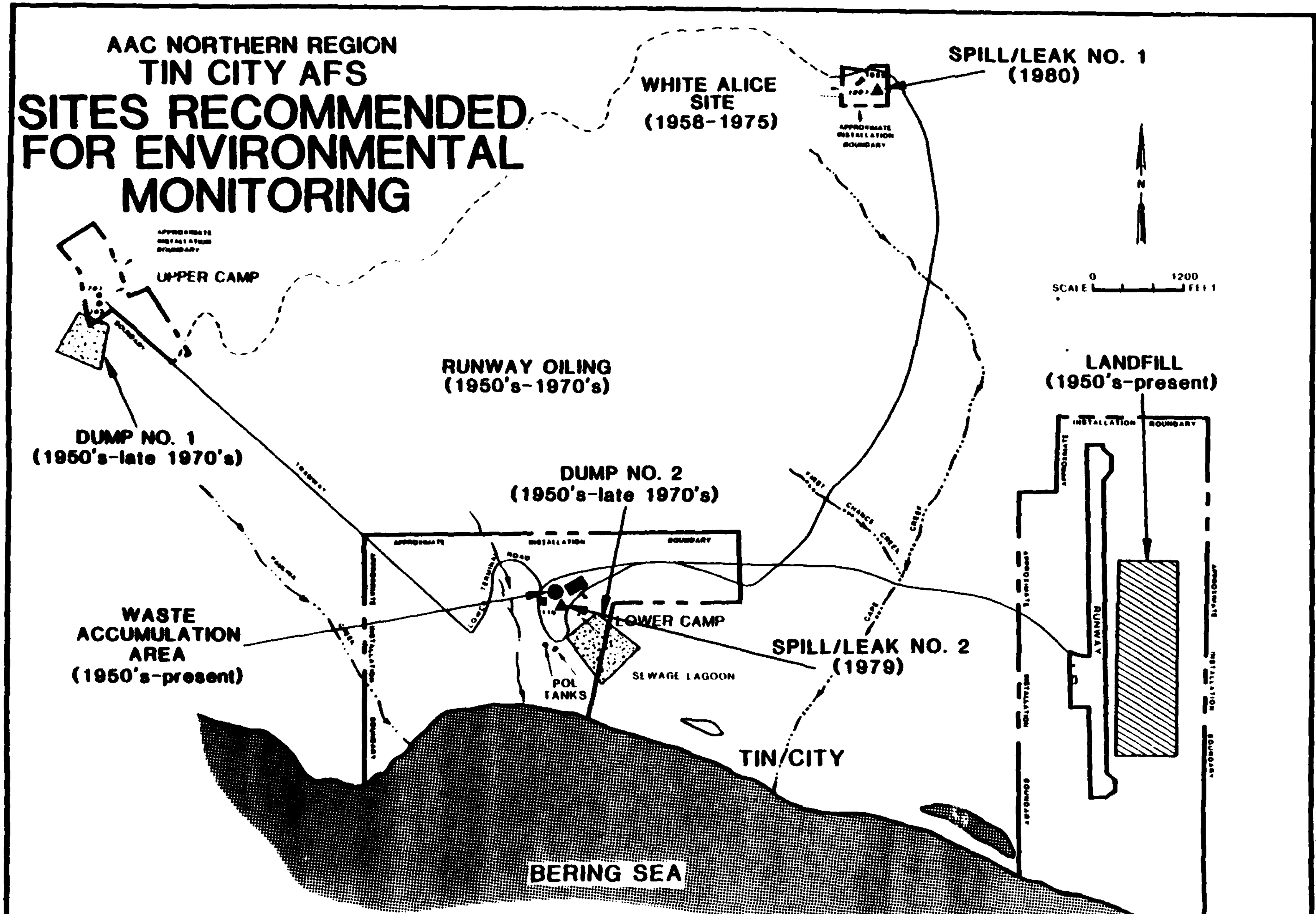
The hydrogeology of the Tin City AFS Lower Camp consists of a thin layer of mixed talus and alluvium overlying bedrock at shallow depths. Ground water occurs in the secondary openings of local bedrock including faults, fractures, fissures, etc., at highly variable depths below ground surface. It is recharged at the base by infiltration of precipitation and streamflow seepage through the highly permeable surficial materials present at or near ground surface. Seasonal ground water may occur in unconsolidated materials, above the top of bedrock. The occurrence of permafrost is thought to be generally limited to the layers of fine-grained sediments that may be present in the study area.

The hydrogeology of the Tin City AFS Upper Camp consists of thin gravelly, bouldery residuum overlying bedrock. Bedrock crops out frequently. Ground water, if present, may occur in the secondary openings of local bedrock or may be trapped seasonally in the residual materials as perched water.

Tin City AFS is a relatively small installation, divided into an Upper Camp and a Lower Camp. An inactive White Alice Communications System site is set apart from the two operational camps. The environmental setting of the installation is not complex. The six disposal sites identified at Tin City AFS (Figure 6.11) were evaluated, utilizing the Phase II Investigation Decision Path, Figure 6.1. It has been determined that the receiving environment proximate to these sites can be efficiently studied by performing a basic study (Figure 6.2) at the identified locations. The basic study performed at the sites should focus on soil, surface water and ground-water quality to detect contaminant migration.

The generalized recommendations for Phase II IRP investigations at Tin City AFS are summarized in Table 6.10. Also included in Table 6.10 are specific analyses for drinking quality protection. The installation drinking water collection system is at risk to potential contaminant migration.

FIGURE 6.11



SOURCE: INSTALLATION DOCUMENTS

TABLE 6.10

RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP AT TIN CITY AFS

Site No.	Site Name*	HARM Score	Recommended Monitoring	Sample Analyses (Table 6.3)	Comments
1	Dump No. 1 (UC)	68	Perform a basic study: sample surface water and sediments in Paulina Creek below site at two points.	C, D	Extend the sampling program down stream if contamination is indicated
2	Landfill (LC)	62	Perform a basic study: perform a geophysical study to determine landfill dimensions. Excavate test pits along site perimeter at 1000 ft. intervals. Sample soils and/or ground water occurring below landfill base.	C, D	Expand the sampling program if contamination is indicated.
3	Dump No. 2 (LC)	60	Perform a basic study: perform a geophysical study to determine landfill dimensions. Excavate test pits along site perimeter at 1000 ft. intervals. Sample soils and/or ground water occurring below landfill base.	C, D	Expand the sampling program if contamination is indicated.
4	Waste Accumulation Area (LC)	58	Perform a basic study: sample soils beneath site to a depth of 5 ft. by excavating a shallow test pit. Composite representative samples for 1-2 ft. and 4-5 ft. depth increments.	C	Expand the sampling program if contamination is indicated.
5	White Alice	52	Perform a basic study: sample unconsolidated materials at 1-2 ft. and 4-5 ft. depth increments, using a 5 by 5 ft. square grid across the site.	B	Expand the sampling program if contamination is indicated.
6	Runway Oiling (LC)	50	Perform a basic study: sample unconsolidated materials at 1-2 ft. and 4-5 ft. depths along runway centerline, at 1000 ft. intervals. Obtain a control sample opposite each runway sample.	C	Expand the sampling program if contamination is indicated.
-	Water Supply Wells and Gallery	-	Sample and Analyze	G	Annual testing recommended.

* LC = Lower Camp; UC = Upper Camp

Source: Engineering-Science

RECOMMENDED GUIDELINES FOR LAND USE RESTRICTIONS

It is desirable to formulate land use restrictions for the various types of disposal sites for the following reasons:

- o Protect human health, welfare and the environment.
- o Insure that contaminant migration is not promoted through improper land utilization.
- o Assist planning efforts in the compatible development of future USAF facilities.
- o To support the identification of property which may be proposed for excess or outlease.

The recommended guidelines for land use restrictions have been developed, based on the type of disposal site that may be present at a given installation. The recommendations are presented by type of facility or activity. For example, the land use restrictions recommended for implementation at a former landfill site would be identical, whether the landfill was located at Galena AFS, Cape Lisburne AFS or Indian Mountain AFS. Site location is not nearly as critical to these considerations as is the type of facility. Therefore, the land use recommendations are based upon the following seven types of disposal sites/waste management facilities that were studied at the eight AAC Northern Region installations:

1. Waste accumulation areas - Refers to sites used for storing all types of used materials, primarily liquid.
2. POL spill/leak areas - Refers to any definable incident related to the transfer, storage or use of POL products which resulted in the loss of liquids directly into the receiving environment.
3. Fire protection training areas - Refers to areas used for burning combustible materials on the ground.
4. Landfills - Refers to an engineered or otherwise managed facility receiving solid wastes.
5. Dumps - Refers to uncontrolled area used for the end disposal of almost any type of material.

6. Road/runway oiling - Refers to the surface application of oils on unimproved roads and runways to control dust.

7. White Alice - Refers to spills/leaks of suspected PCB-bearing oils at inactive communication facilities.

The recommended guidelines for land use restrictions at each type of identified site at AAC Northern Region installations are presented in Table 6.11. A description of the land use restriction guidelines is included in Table 6.12. Land use restrictions at sites recommended for on-site environmental monitoring should be re-evaluated upon completion of the Phase II program and changes made accordingly.

TABLE 6.11
RECOMMENDED GUIDELINES FOR FUTURE LAND USE RESTRICTIONS

Site Name	Construction	Excavation	Wells	Agriculture	Silviculture	Water Infiltration	Recreation	Burning	Disposal Operations	Vehicular Traffic	Material Storage	Housing
1. Waste Accumulation Areas	R	R	R	NA	R	R	R	R	R	NR	PU	R
2. POL Spill/Leak Areas	R	R	R	NA	R	R	R	R	R	NR	R	R
3. Fire Protection Training Areas	NR	NR	R	NA	R	R	R	PU	R	NR	NR	R
4. Landfills	R	R	R	NA	R	R	R	R	PU	NR	NR	R
5. Dumps	R	R	R	NA	R	R	R	R	R	NR	R	R
6. Road/Runway Oiling	PU	PU	R	NA	R	R	NA	R	R	PU	R	R
7. White Alice	NR	NR	R	NA	NR	R	NR	NR	NR	NR	NR	R

Notes: NR = No Restriction

R = Restrictions Apply (See Table 6.12)

PU = Present Use

NA = Not Applicable

Source: Engineering-Science

TABLE 6.12
DESCRIPTION OF GUIDELINES FOR LAND USE RESTRICTIONS

Guideline	Description
Construction on the site	Restrict the construction of structures which make permanent (or semi-permanent) and exclusive use of a portion of the site's surface.
Excavation	Restrict the disturbance of the cover or subsurface materials.
Well construction on or near the site	Restrict the placement of any wells (except for monitoring purposes) on or within a reasonably safe distance of the site. This distance will vary from site to site, based on prevailing soil conditions and ground-water flow.
Agricultural use	Restrict the use of the site for agricultural purposes to prevent food chain contamination.
Silvicultural use	Restrict the use of the site for silvicultural uses (root structures could disturb cover or subsurface materials).
Water infiltration	Restrict water run-on, ponding and/or irrigation of the site. Water infiltration could produce contaminated leachate.
Recreational use	Restrict the use of the site for recreational purposes.
Burning or ignition sources	Restrict any and all unnecessary sources of ignition, due to the possible presence of flammable compounds.
Disposal operations	Restrict the use of the site for waste disposal operations, whether above or below ground.
Vehicular traffic	Restrict the passage of unnecessary vehicular traffic on the site due to the presence of explosive material(s) and/or of an unstable surface.
Material storage	Restrict the storage of any and all liquid or solid materials on the site.
Housing on or near the site	Restrict the use of housing structures on or within a reasonably safe distance of the site.

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(Continued)

APPENDIX A

BIOGRAPHICAL DATA

Biographical Data

ROBERT L. THOEM
Civil/Environmental Engineer

PII Redacted

[redacted]

Education

B.S. Civil Engineering, 1962, Iowa State University, Ames, IA
M.S. Sanitary Engineering, 1967, Rutgers University, New Brunswick, NJ

Professional Affiliations

Registered Professional Engineer in six states
American Academy of Environmental Engineering (Diplomate)
American Society of Civil Engineers (Fellow)
National Society of Professional Engineers (Member)
Water Pollution Control Federation (Member)

Honorary Affiliations

Who's Who in Engineering
Who's Who in the Midwest
USPHS Traineeship

Experience Record

1962-1965 U.S. Public Health Service, New York, NY. Staff Engineer, Construction Grants Section (1962-1964). Technical and administrative management of grants for municipal wastewater facilities.

Water Resources Section Chief (1964-1965). Supervised preparation of regional water supply and pollution control reports.

1966-1983 Stanley Consultants, Muscatine, IA and Atlanta, GA. Project Manager and Project Engineer (1966-1973). Responsible for managing studies and preparing reports for a variety of industrial and governmental environmental projects.

Environmental Engineering Department Head (1973-1976). Supervised staff involved in auditing environmental practices, conducting studies and preparing reports concerning water and wastewater systems, solid waste and resource recovery and water resources projects (industrial and governmental).

Robert L. Thoem (Continued)

Resource Management Department Head (1976-1982). Responsible for multidiscipline staff engaged in planning and design of water and wastewater systems, solid waste and resource recovery, water resources, bridge, site development and recreational projects (industrial, domestic and foreign governments).

Associate Chief Environmental Engineer (1980-1983). Corporate-wide quality assurance responsibilities on environmental engineering planning projects.

Operations Group Head and Branch Office Manager (1982-1983). Directed multidiscipline staff responsible for planning and design of steam generation, utilities, bridge, water and wastewater systems, solid waste and resource recovery, water resources, site development and recreational projects (industrial, domestic and foreign governments). Administered branch office support activities.

Project Manager/Engineer for over 25 industrial projects, 25 city and county projects ranging in present study area population from 1,400 to 1,700,000, 10 regional (multi-county) planning or operating agency projects, five state agency projects, 10 projects for federal agencies, and several projects for Middle East governments.

1983-Date Engineering-Science. Senior Project Manager. Responsible for managing a variety of environmental projects. Conducted hazardous waste investigations at seven U.S. Air Force installations to identify the potential migration of contaminants resulting from past disposal practices under the Phase I Installation Restoration Program. Evaluated solid waste collection, disposal and potential for resource recovery at a U. S. Army post. Process selection and preliminary design studies and reports for expanding a municipal advanced wastewater treatment plant from 36 mgd to 54 mgd.

Publications and Presentations

Over thirteen presentations and/or papers in technical publications dealing with solid waste, sludge, water, wastewater and project cost evaluations.

Biographical Data

JOHN R. ABSALON
Hydrogeologist

PII Redacted

[redacted]

Education

B.S. in Geology, 1973, Upsala College, East Orange, New Jersey

Professional Affiliations

Certified Professional Geologist (Indiana No. 46) (Virginia No. 241)
Association of Engineering Geologists
Geological Society of America
National Water Well Association

Experience Record

1973-1974 Soil Testing Incorporated-Drilling Contractors, Seymour, Connecticut. Geologist. Responsible for the planning and supervision of subsurface investigations supporting geotechnical, ground-water contamination, and mineral exploitation studies in the New England area. Also managed the office staff, drillers, and the maintenance shop.

1974-1975 William F. Loftus and Associates, Englewood Cliffs, New Jersey. Engineering Geologist. Responsible for planning and management of geotechnical investigations in the northeastern U.S. and Illinois. Other duties included formal report preparation.

1975-1978 U.S. Army Environmental Hygiene Agency, Fort McPherson, Georgia. Geologist. Responsible for performance of solid waste disposal facility siting studies, non-complying waste disposal site assessments, and ground-water monitoring programs at military installations in the southeastern U.S., Texas, and Oklahoma. Also responsible for operation and management of the soil mechanics laboratory.

1978-1980 Law Engineering Testing Company, Atlanta, Georgia. Engineering Geologist/Hydrogeologist. Responsible for the project supervision of waste management, water quality assessment, geotechnical, and hydrogeologic studies at commercial, industrial, and government facilities. General experience included planning and management of several ground-water monitoring programs,

John R. Absalon (Continued)

development of remedial action programs, and formulation of waste disposal facility liner system design recommendations. Performed detailed ground-water quality investigations at an Air Force installation in Georgia, a paper mill in southwestern Georgia, and industrial facilities in Tennessee.

1980-Date Engineering-Science. Hydrogeologist. Responsible for supervising efforts in waste management, solid waste disposal, ground-water contamination assessment, leachate generation, and geotechnical and hydrogeologic investigations for clients in the industrial and governmental sectors. Performed geologic investigations at twelve Air Force bases and otherindustrial sites to evaluate the potential for migration of hazardous materials from past waste disposal practices. Conducted RCRA ground-water monitoring studies for industrial clients and evaluated remedial action alternatives for a county landfill in Florida. Conducted quality management, hydrogeologic and ground-water quality programs for the pulp and paper industry at several mills located in the Southeast United States.

Publications and Presentations

Eleven presentations and/or papers in technical publications or conferences dealing with geology, ground water, and waste disposal/-ground water interaction.

BIOGRAPHICAL DATA

Rocco M. Palazzolo
Environmental Engineer

PII Redacted

[redacted]

Education

B.S. in Civil Engineering, Wayne State University, 1981
M.S. in Environmental Engineering, Georgia Institute of Technology, 1983.

Professional Affiliations

Water Pollution Control Federation

Honorary Affiliation

Tau Beta Pi

Experience Record

1974-1976 R. D. Palazzolo Associates, Consulting Engineers, P.C., Detroit, Michigan. Engineering Assistant responsible for vendor follow-up during expansion of an transmission manufacturing plant. Acted as liaison between automobile manufacturer and vendors of machine tools, fixtures, gages, etc. Duties included preparation of weekly progress reports, maintenance of records, informing vendors of design changes, etc.

1978-1981 R. D. Palazzolo Associates, Consulting Engineers, P.C., Detroit, Michigan. Checked designs of machine tools, fixtures, gages, and materials handling equipment. Also served as Manufacturers' Representative for tool and die shops.

1981-1983 Georgia Institute of Technology, Atlanta, GA. Graduate Research Assistant in projects including development of a means to improve hydraulic behavior of fluidized bed reactors, review and experimental testing of hydraulic models of fluidization and sedimentation, and a study of absorption enhanced anaerobic treatment of coal gassification wastewater. Responsible for design and construction of experimental apparatus, system operation and maintenance, experimental measurements and analyses, review of

Rocco M. Palazzolo
Page 2

data and preparation of reports. Also taught undergraduate classes in water distribution and sewer system collection design.

1983-Date Engineering-Science, Inc., Atlanta, GA. Project Engineer responsible for preparation of a RCRA Part B Permit Application. Work included review of hazardous waste management practices and facilities at the plant for compliance with federal and state regulations. Hazardous waste management processes included container and tank storage, disposal in an on-site secure landfill, and treatment by incineration.

Project Engineer responsible for investigation of environmental impact of a closed garbage and rubbish landfill on a proposed apartment development, including investigation of pollution of ground water and surface water in a nearby stream. Work included development of the history of the landfill, field sampling and measurements, review of data, and presentation of recommendations.

Publications

Khudenko, B.M. and Palazzolo, R.M. "Hydrodynamics of Fluidized Bed Reactors for Wastewater Treatment". Proceedings: First International Conference on Fixed Film Biological Processes, April 20-23, 1982, Kings Island, Ohio, Vol. 3, pp. 1288-1334.

Palazzolo, R.M. and Khudenko, B.M. "Development of A New Type of Fluidized Bed Reactor". International Conference on Scale-up of Water and Wastewater Treatment Processes, March 17 and 18, 1983, Edmonton, Alberta, Canada.

APPENDIX B

LIST OF INTERVIEWEES AND OUTSIDE AGENCY CONTACTS

TABLE B.1
LIST OF INTERVIEWEES

Most Recent Position	Years of Service at Indicated Installation	Years of Service at Other AAC Installations
Galena AFS/Campion AFS		
1. Chief, Operations and Maintenance	30	---
2. Civil Engineer/Environmental Coordinator	1	---
3. Civil Engineer	1	---
4. Chief, Aircraft Maintenance	1	---
5. Chief, Fire Department	1	---
6. NCOIC, Barrier Maintenance	1	---
7. NCOIC, Fuels Management, Quality Control	1	---
8. NCOIC, Liquid Fuels Maintenance	1	---
9. NCOIC, Missile Maintenance	1	---
10. Supervisor, Utilities	19	---
11. NCOIC, AGE	1	---
12. Mechanic, AGE	1	---
13. Chief, Transportation	1	---
14. Superintendant, Electronic Equipment Maintenance	1	---
15. Foreman, Paint and Carpentry Shop	8	---
16. NCOIC, Composite Shop	2	---
17. Mechanic, Heating Shop	11	---
18. Mechanic, Heating Shop	3	---
19. Foreman, Power Plant	8	---
20. Superintendant, MAR Tower	2	---

TABLE B.1
LIST OF INTERVIEWEES
(CONTINUED)

Most Recent Position	Years of Service at Indicated Installation	Years of Service at Other AAC Installations
Cape Lisburne AFS		
1. Station Supervisor	1	3
2. Station Mechanic/Vehicle Maintenance	4	2
3. Station Mechanic/Power Plant	1	8
Fort Yukon AFS		
1. Station Chief	9	---
2. Electronics Technician	1	3
3. Station Mechanic	5	---
4. ALASCOM Representative	3	---
Indian Mountain AFS		
1. Station Supervisor	1	8
2. Electronic Technician	9	---
3. Station Mechanic	1	8
Kotzebue AFS		
1. Station Chief	1	3
2. Electronics Technician	2	---
3. Roads and Grounds Foreman (Former)	15	---
Murphy Dome AFS		
1. Station Supervisor	9	---
2. Station Mechanic	5	4
3. Station Mechanic	11	---
4. Station Chief	7	2

TABLE B.1
LIST OF INTERVIEWEES
(CONTINUED)

Most Recent Position	Years of Service at Indicated Installation	Years of Service at Other AAC Installations
5. Electronic Technician	10	---
6. Electronic Technician	12	---
7. CE Supervisor (Former)	16	2
<u>Tin City AFS</u>		
1. Station Chief	4	---
2. Station Mechanic/Power Plant	1	4
3. Station Support/Supply	1	---
4. Station Support	2	1
5. Station Mechanic/Power Plant	1	7
6. Station Mechanic/Vehicle Maintenance	1	---
<u>Elmendorf AFB</u>		
1. Structural Planner, 5099th CEOS	---	13
2. Chief, Operating Engineers, 5099th CEOS	---	23
3. Assistant Chief, Operating Engineers, 5099th CEOS	---	11
4. Environmental Coordinator, AAC	---	3
5. Bioenvironmental Engineer, AAC	---	8
6. LRR CE Coordinator, 11th TCG	---	5
7. NCOIC, History, AAC	---	1
8. NCO Bioenvironmental Engineering, AAC	---	2

TABLE B.2
OUTSIDE AGENCY CONTACTS

Agency/Point of Contact
Jacques Gusmano Environmental Scientist Superfund/Hazardous Waste Alaska Operations Office U. S. Environmental Protection Agency Federal Building 701 C Street Anchorage, AK 99513 (907) 271-5083
Arvilla McAllester, Land Law Examiner Pat Bower, Land Law Examiner Property Management Branch U. S. Bureau of Land Management Federal Building 701 C Street Anchorage, AK 99513 (907) 271-5060
Earl Layser, Natural Resources Specialist Hazardous Materials Management Biological Resources Branch U. S. Bureau of Land Management Federal Building 701 C Street Anchorage, AK 99513 (907) 271-5614
Dennis L. Money, Chief Endangered Species Section U. S. Fish and Wildlife Service 1011 East Tudor Road Anchorage, AK 99503 (907) 876-3442
Clarence E. Furbush, Soil Scientist Joseph P. Moore, Soil Scientist U. S. Department of Agriculture, Soil Conservation Service 201 East 9th Avenue Suite 300 Anchorage, AK 99501 (907) 261-2405
Raymond S. George, Associate District Chief Liska Snyder, Hydrologist U. S. Geological Survey Water Resources Division District Office 4230 University Drive, Suite 201 Anchorage, AK 99508 (907) 271-4138

TABLE B.2
OUTSIDE AGENCY CONTACTS
(Continued)

Agency/Point of Contact
Pat J. Still, Hydrologist Richard Snyder, Hydrologic Technician U. S. Geological Survey Water Resources Division Subdistrict Office 1209 Orca Street Anchorage, AK 99501 (907) 271-4153
John Lovett, Chief Defense Environmental Restoration Program (Building 21-116, Elmendorf AFB) Alaska District, U.S. Army Corps of Engineers Post Office Box 898 Anchorage, AK 99506 (907) 753-2703
Kenneth E. Hitch, P.E., Hydraulic Engineer Flood Plain Management Services (Building 21-700, Elmendorf AFB) Alaska District, U. S. Army Corps of Engineers Post Office Box 898 Anchorage, AK 99506 (907) 753-2612
Leroy J. Marcus, Realty Specialist Real Property Division (Building 10-400, Elmendorf AFB) Alaska District, U. S. Army Corps of Engineers Post Office Box 898 Anchorage, AK 99506 (907) 753-2850
Bruce E. Erickson, Environmental Engineer Alaska Department of Environmental Conservation 437 E Street Anchorage, AK 99501 (907) 274-2533
Jeffrey Mach, Field Officer Northern Regional Office Alaska Department of Environmental Conservation Post office Box 1601 Fairbanks, AK 99707 (907) 452-1714

TABLE B.2
OUTSIDE AGENCY CONTACTS
(Continued)

Agency/Point of Contact
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Kim Francisco, Biologist Alaska Department of Fish and Game Post Office Box 90 Bethel, AK 99559 (907) 543-2433
Barbara Sokolov, Library Manager University of Alaska Arctic Environmental Information and Data Center 707 A Street Anchorage, AK 99501 (907) 279-4523

APPENDIX C

TENANT ORGANIZATIONS AND MISSIONS

APPENDIX C

TENANT ORGANIZATIONS AND MISSIONS

Alascom is the major tenant at the forward operating base and long-range radar sites. Alascom's mission is to operate and maintain earth stations for a satellite communication system which provides civilian and military communications.

APPENDIX D

SUPPLEMENTAL INSTALLATION FINDINGS INFORMATION

TABLE D.1

LIQUID FUEL AND WASTE OIL TANKS

Installation	Facility	Above (A) or Below (B) Ground	Tank Size (gal)	Tank Contents	Active (A) or Inactive (IA)
Galena AFS	400	A	560	Diesel	A
	1400	B	2,000	Diesel	A
	1401	B	2,000	Diesel	A
	1403	A	300	Diesel	A
	1428	A	50	Diesel	A
	1428	B	10,000	Diesel	IA
	1499	B	12,000	Diesel	IA
	1499	B	12,000	Diesel	A
	1499	B	25,000	Diesel	A
	1499	B	25,000	Diesel	A
	1551	A	1,000	Diesel	A
	1552	A	1,632	Diesel	A
	1578	A	300	Mogas	A
	1770	A	1,000	Waste Oil	IA
	1770	A	1,000	Diesel	A
	1880	A	1,000	Diesel	A
	2124	A	500	Diesel	IA
	Tanks 39 & 40	A	2 @ 50,000	Isopropyl Alcohol	A
	Tanks 9-16	A	8 @ 25,000	AVGAS	A
	Tanks 1-8	A	8 @ 25,000	Mogas	A
	Tanks 25-33	A	9 @ 50,000	Diesel	A
	Tank 43	A	2,600	Diesel	A
	1713 (Tank 37)	B	1,176,000	Diesel	A
	1716 (Tank 38)	B	1,176,000	JP-4	A
	Tank 41	A	400,156	JP-4	A

TABLE D.1
LIQUID FUEL AND WASTE OIL TANKS

Installation	Facility	Above (A) or Below (B) Ground	Tank Size (gal)	Tank Contents	Active (A) or Inactive (IA)
Galena AFS (Continued)	Tank 42	A	796,283	Diesel	A
	1572	B	2,000	Reclaimed JP-4	A
	1556	A	300	Diesel	A
	1557	A	500	Diesel	A
	1833	A	500	Mogas/Oil	A
	1428	A	50	Mogas	A
	1757	A	200	Diesel	A
	1759	A	200	Diesel	A
Campion AFS	Tank 1	A	285,600	Diesel	IA
	Tank 2	A	285,600	Diesel	IA
	Tank 3	B	10,000	Diesel	IA
	Tank 4	B	6,000	Mogas	IA
	Tank 5	B	6,000	Mogas	IA
	Tank 6	B	1,000	Mogas	IA
	Tank 7	A	285	Diesel	IA
	Tank 8	A	285	Diesel	IA
	Tank 9	A	88,200	Diesel	IA
	Tank 10	A	50,000	Diesel	IA
	Tank 11	A	50,000	Diesel	IA
	105	A	500	Diesel	IA
	1018	A	250	Diesel	IA
	1018	A	100	Diesel	IA

TABLE D.1
(Continued)
LIQUID FUEL AND WASTE OIL TANKS

Installation	Facility	Above (A) or Below (B) Ground	Tank Size (gal)	Tank Contents	Active (A) or Inactive (IA)
Cape Lisburne AFS	Tanks 1 & 2 (77525)	A	2 @ 492,000	Diesel	A
	Tank 3 (76200)	A	25,000	Mogas	A
	Tank 5	B	6,000	Diesel	A
	151	PB	26,550	Diesel	A
	151	PB	4,500	Diesel	A
	Tank 7 (301)	A	300	Diesel	IA
	Tank 8 (301)	A	300	Diesel	IA
	Tank 9 (301)	A	70	Diesel	IA
	301	A	4,500	Diesel	IA
	Tank 10 (1001)	A	300	Diesel	IA
	Tank 11 (1001)	A	1,000	Diesel	IA
	Tank 12 (1001)	A	150	Diesel	IA
	Tank 13 & 14 (1001)	A	2 @ 20,000	Diesel	IA
	Tank 15 (1001)	A	1,000	Diesel	IA
	Tank 16 & 17 (1001)	A	2 @ 1,500	Diesel	IA
	152	A	500	Diesel	IA
	Double Bottom Tanks	A	2 @ 24,000	AVGAS	A
Fort Yukon AFS	100	A	110	Mogas	IA
	102	A	500	Diesel	A
	103	A	9 @ 250	Diesel	IA
	Tank 19 (104)	A	10,000	Diesel	A
	106	A	200	Diesel	A
	114	A	2,500	Diesel	IA
	115	A	500	Diesel	IA
	1001	A	275	Diesel	IA

TABLE D.1
(Continued)
LIQUID FUEL AND WASTE OIL TANKS

Installation	Facility	Above (A) or Below (B) Ground	Tank Size (gal)	Tank Contents	Active (A) or Inactive (IA)
Fort Yukon AFS	Tank 31 (1055)	A	300	Diesel	IA
	76200	B	5,000	Mogas	A
	Tanks 20 & 21 (77525)	A	314,000	Diesel	A
	Tank 23 (77525)	A	514,000	Diesel	A
	NCF	A	15,000	Diesel	A
Indian Mountain AFS	110	A	1,000	Diesel	IA
	110	A	35	Mogas	IA
	110	A	10,000	Diesel	IA
	118	A	300	Misc.	IA
	125	A	500	Diesel	A
	210	A	1,500	Diesel	IA
	221	A	500	Diesel	A
	227	A	1,000	Diesel	IA
	228	A	6,000	Diesel	IA
	230	A	200	Mogas	A
	1001	A	275	Diesel	IA
	1051	A	400	Diesel	IA
	1105	A	19,500	Diesel	IA
	1105	A	19,500	Diesel	IA
	1140	A	275	Mogas	IA
	1140	A	275	Mogas	IA
	76200	A	2,200	Mogas	IA
	Tank 1 (LC)	A	10,000	Diesel	A
	Tanks 2-7 (LC)	A	6 @ 12,000	Diesel	A
	Tank 8	A	34,000	Diesel	A
	Tank 9	A	34,000	Diesel	A

TABLE D.1
(Continued)
LIQUID FUEL AND WASTE OIL TANKS

Installation	Facility	Above (A) or Below (B) Ground	Tank Size (gal)	Tank Contents	Active (A) or Inactive (IA)
Indian Mountain AFS	Tank 10	A	480,000	Diesel	A
	110	A	400	Diesel	IA
	110	A	400	Diesel	IA
	110	A	1,000	Mogas	A
	110	A	1,200	Waste Oil	IA
	Tank 1 (UC)	A	214,200	Diesel	IA
	Tank 2 (UC)	A	214,200	Diesel	IA
Kotzebue AFS	103	A	17 @ 200	Diesel	IA
	Tank 5 (104)	A	500	Diesel	IA
	Tank 26 (106)	A	500	Diesel	IA
	Tank 20 (110)	A	110	Mogas	IA
	Tank 4 (110)	A	500	Diesel	IA
	119	A	150	Diesel	IA
	Tank 24 (119)	A	850	Diesel	IA
	Tank 19 (203)	A	200	Diesel	IA
	Tank 23 (205)	A	2,500	Diesel	IA
	1001	A	300	Diesel	IA
	1015	A	1,000	Diesel	IA
	1105	PB	2 @ 10,00	Diesel	IA
	1126	A	4,000	Diesel	IA
	Tank 22 (76200)	A	25,000	Diesel	A
	Tank 21 (77540)	A	25,000	Mogas	A
	Tank 2 (76200)	A	5,000	Mogas	A
	77525	A	2 @ 331,380	Diesel	IA
	77525	A	273,000	Diesel	IA
	Tank 1 (77525)	A	50,000	Diesel	A

TABLE D.1
(Continued)
LIQUID FUEL AND WASTE OIL TANKS

Installation	Facility	Above (A) or Below (B) Ground	Tank Size (gal)	Tank Contents	Active (A) or Inactive (IA)
Murphy Dome AFS	110	A	300	Diesel	A
	110	A	300	Diesel	A
	110	B	200	Mogas	IA
	110	B	10,000	Diesel	A
	112	A	1,000	Diesel	A
	202	A	105	Fuel Oil	IA
	1001	A	50	Diesel	A
	76200	B	6,000	Diesel	A
	76200	B	6,000	Mogas	A
	76200	B	1,000	Mogas	A
	77525	A	137,300	Diesel	A
	77525	A	214,200	Diesel	A
	1001	B	2,000	Diesel	A
Tin City AFS	Tank 9 (110)	B	300	Mogas	A
	Tank 3 (110)	B	10,000	Diesel	A
	Tanks 7 & 8 (110)	A	2 @ 285	Diesel	A
	Tanks 20 & 21 (113)	A	2 @ 285	Diesel	A
	Tank 14 (123)	A	285	Diesel	A
	Weather Station (132)	B	4,000	Diesel	A
	Weather Station (132)	A	5,000	Diesel	A
	Weather Station (132)	A	285	Diesel	A
	Incinerator (142)	A	500	Diesel	A
	150	B	250	Diesel	A

TABLE D.1
(Continued)
LIQUID FUEL AND WASTE OIL TANKS

Installation	Facility	Above (A) or Below (B) Ground	Tank Size (gal)	Tank Contents	Active (A) or Inactive (IA)
Tin City AFS (Continued)	Tank 12 (203)	A	5,000	Diesel	A
	Tank 6 (76200)	B	1,000	Diesel	IA
	Tank 5 (76200)	B	6,000	Mogas	A
	Tanks 1 & 2 (77525)	A	2 @ 492,240	Diesel	A
	Tank 10 (77540)	A	25,000	Mogas	A
	Tank 13 (89004)	A	2,000	Diesel	A

PB = Partially buried.
LC = Lower Camp UC = Upper Camp

Note: Numerous discr pancies on tank inventory data were found among the installation reports, facility drawings, real property records and interviewee discussions. Thus, this represents an approximate tank inventory.

Source: Installation documents and interviews.

TABLE D.2

GALENA AFS AND CAMPION AFS CLIMATOLOGICAL DATA

MONTH	Temperature (°F) Mean Daily Max	Temperature (°F) Mean Daily Min	Temperature (°F) Mean Monthly	Temperature (°F) Extreme Max	Temperature (°F) Extreme Min	Precipitation (In) Monthly Mean	Precipitation (In) Monthly Max	Precipitation (In) Monthly Min	Precipitation (In) Max 24 Hrs	Snowfall (In) Monthly Mean	Snowfall (In) Monthly Max	Snowfall (In) Max 24 Hrs	Surface Winds Pvlg. Drctn.	Surface Winds Speed
JAN	-2	17	-9	43	-61	.7	2.2	.2	.9	8	22	9	N	3
FEB	3	-15	-6	41	-57	.8	3.1	#	1.1	9	31	11	N	3
MAR	15	-6	5	50	-54	.7	2.0	#	.6	8	19	6	N	4
APR	31	13	22	60	-35	.7	2.9	#	.6	7	28	4	N	4
MAY	54	35	45	82	-1	.5	1.2	.1	.5	1	3	2	N	4
JUN	65	49	57	92	29	1.3	2.7	.1	1.3	#	#	#	N	4
JUL	68	52	60	89	36	2.0	3.8	.7	1.0	#	#	#	WSW	4
AUG	63	48	56	87	28	2.2	4.8	.5	1.8	#	#	#	SW	3
SEP	51	37	44	75	12	1.4	4.3	.1	1.2	1	3	2	N	4
OCT	29	18	23	56	-29	1.1	2.4	.3	.7	9	23	8	N	4
NOV	10	-3	4	45	-49	1.0	2.3	.1	.8	12	27	8	N	4
DEC	-3	-17	-10	44	-62	13.1	4.8	#	1.6	64	31	11	N	3
ANN	32	16	24	92	-62	13.1	4.8	#	1.6	64	31	11	N	4
EYR	30	30	30	30	30	30	30	30	30	30	30	30	10	10

Period of Record: May 1953 - May 1982
Source: 11th Weather Squadron, Elmendorf AFB, AK
Note: # indicates trace accumulations.
Climatic events measured and recorded at Galena AFS

EYR - Years of record
ANN - Annual average

TABLE D.3
CAPE LISBURNE AFS CLIMATOLOGICAL DATA

MONTH	Temperature (°F) Mean Daily Max	Mean Daily Min	Mean Monthly	Extreme Max	Extreme Min	Precipitation (In) Monthly Mean	Monthly Max	Monthly Min	Max 24 Hrs	Snowfall (In) Monthly Mean	Monthly Max	Max 24 Hrs	Surface Winds Pvlg. Drctn.	Speed
JAN	5	-6	-1	39	-38	.4	2.4	#	.62	4	11	62	ESE	11
FEB	-4	-14	-9	45	-47	.4	2.0	#	.9	4	20	9	ESE	10
MAR	-2	-12	-7	44	-39	.3	1.0	#	.5	3	10	5	ESE	9
APR	11	1	6	46	-22	.4	2.1	#	.5	4	14	3	E	9
MAY	29	21	25	52	-6	.4	1.7	#	.8	3	8	4	E	8
JUN	42	33	38	62	20	.7	2.4	#	.9	1	6	3	E	7
JUL	50	41	46	73	29	1.8	4.5	.1	1.4	1	8	7	E	8
AUG	49	42	45	72	29	3.0	6.3	.5	1.8	1	7	4	E	9
SEP	41	35	38	71	15	2.2	5.1	.2	1.1	3	13	5	E	10
OCT	26	19	23	57	-12	1.4	3.7	#	1.0	12	36	10	E	12
NOV	13	5	9	42	-23	.9	3.9	#	1.1	8	36	11	E	11
DEC	3	-7	-2	43	-40	.4	1.6	#	.9	4	16	9	E	10
ANN	22	13	18	73	-47	12.3	6.3	#	1.8	48	36	11	E	9
EYR	16	16	16	16	16	26	26	26	26	27	27	27	10	10

Period of Record: May 1953 - May 1982
SOURCE: 11th Weather Squadron, Elmendorf AFB, AK
Note: # indicates trace accumulations.

EYR - Years of record
ANN - Annual average

TABLE D.4
FORT YUKON AFS CLIMATIC DATA

Month	Temperature Mean Max(°F)	Temperature Mean Min(°F)	Rainfall Precipitation Mean (in)	Rainfall Precipitation Max (in)	Snowfall Precipitation Mean (in)	Snowfall Precipitation Max (in)	Wind Mean Speed (kts)	Wind Prevailing Direction
Jan.	-12	-29	0.6	0.5	7	5	4	NE
Feb.	-5	-26	0.4	0.3	5	4	5	NE
Mar.	13	-14	0.3	0.2	5	3	7	NE
Apr.	33	8	0.2	0.3	3	3	8	NE
May	56	32	0.3	0.4	1	3	8	NE
June	8-	48	0.6	0.6	-	-	9	WSW
July	72	51	1.0	1.5	0	0	8	WSW
August	67	45	1.1	0.8	#	1	8	WSW
Sept.	50	32	0.9	0.6	1	4	8	NE
Oct.	26	11	0.5	0.6	8	5	7	NE
Nov.	3	-12	0.5	0.3	7	3	4	NE
Dec.	-12	-27	0.5	0.4	7	4	4	NE
Annual	30	10	6.9	1.5	44	5	4	NE

TABLE D.5
INDIAN MOUNTAIN AFS CLIMATOLOGICAL DATA

MONTH	Temperature (°F)					Precipitation (In)				Snowfall (In)			Surface Winds	
	Mean													
	Daily		Monthly	Extreme		Monthly			Max	Monthly		Max	Pvlg.	
	Max	Min		Max	Min	Mean	Max	Min	24 Hrs	Mean	Max	24 Hrs	Drctn.	Speed
JAN	0	-12	-6	40	-65	1.2	3.5	#	2.2	16	46	25	ENE	5
FEB	4	-11	-4	38	-48	.7	1.5	#	.7	10	26	11	ENE	4
MAR	13	-3	5	39	-45	.9	4.6	#	1.0	13	45	9	ENE	5
APR	30	13	21	54	-24	1.1	3.6	#	1.6	14	44	19	ENE	5
MAY	52	34	43	76	-2	.7	1.8	#	1.0	1	15	7	NE	5
JUN	65	46	56	88	30	1.8	3.6	.1	1.5	#	1	1	W	4
JUL	67	48	58	85	30	2.6	5.8	.5	1.2	0	0	0	W	3
AUG	62	44	53	83	23	3.4	8.1	.1	1.7	#	1	1	W	3
SEP	49	33	41	73	8	2.6	10.2	.4	3.3	4	16	10	ENE	4
OCT	27	15	21	55	-25	1.8	4.5	#	1.3	18	47	20	ENE	4
NOV	[illegible]	-2	[illegible]	38	-38	1.4	4.6	#	1.5	11	46	15	E	4
DEC	2	-11	-5	30	-51	1.2	3.6	.1	1.0	15	35	12	ENE	4
ANN	32	10	24	88	-65	19.4	10.2	#	3.3	108	47	25	ENE	4
EYR	18	18	18	18	18	22	22	22	22	22	22	22	10	10

Period of Record: May 1959 - May 1982
SOURCE: 11th Weather Squadron, Elmendorf AFB, AK
Note: # indicates trace accumulations.

EYR - Years of record
ANN - Annual average

TABLE D.6
KOTZEBUE AFS CLIMATOLOGICAL DATA

Month	Temperature		Rainfall Precipitation		Snowfall Precipitation		Wind	
	Mean Max(°F)	Mean Min(°F)	Mean (in)	Max (in)	Mean (in)	Max (in)	Mean Speed (kts)	Prevailing Direction
Jan.	1	-13	0.4	0.8	5	5	13	ESE
Feb.	3	-11	0.3	0.7	6	7	12	E
Mar.	7	-11	0.3	0.5	6	9	11	E
Apr.	23	4	0.3	0.3	5	4	11	ESE
May	38	24	0.3	0.6	2	4	9	W
June	50	38	0.5	0.8	#	2	10	W
July	59	47	1.5	1.8	#	#	11	WNW
August	56	45	2.2	1.5	#	#	12	WNW
Sept.	46	36	1.2	0.9	1	5	11	ESE
Oct.	30	20	0.6	0.5	6	6	11	ESE
Nov.	13	2	0.4	0.3	8	6	12	E
Dec.	3	-10	0.3	0.4	7	8	11	E
Annual	27	14	8.3	1.8	46	9	11	ESE

TABLE D.7
MURPHY DOME AFS CLIMATOLOGICAL DATA

MONTH	Temperature (°F) Mean Daily Max	Mean Daily Min	Mean Monthly	Extreme Max	Extreme Min	Precipitation (In) Monthly Mean	Monthly Max	Monthly Min	Max 24 Hrs	Snowfall (In) Monthly Mean	Monthly Max	Max 24 Hrs	Surface Winds Pvlg. Drctn.	Speed
JAN	-3	-22	-13	47	-61	0.6	2.0	#	-.6	11	31	7	N	2
FEB	7	-16	-5	43	-56	0.5	1.8	0.1	0.9	11	43	16	N	3
MAR	23	-5	9	51	-49	0.5	2.1	#	0.9	8	30	13	N	4
APR	40	18	30	74	-21	0.3	.8	#	0.3	4	11	5	N	5
MAY	58	36	48	89	-1	0.5	1.7	0.1	0.8	1	5	5	N	6
JUN	70	48	59	96	30	1.4	3.6	0.2	1.4	0	0	0	SW	6
JUL	71	50	61	93	34	2.1	4.4	0.4	1.8	0	0	0	SW	5
AUG	66	45	56	87	23	2.1	6.2	0.4	3.4	#	#	#	SW	5
SEP	55	35	45	84	12	1.0	3.1	0.1	1.2	1	5	2	N	5
OCT	33	17	25	65	-19	0.6	1.5	0.1	0.6	8	24	7	N	4
NOV	11	-6	3	48	-43	0.6	2.1	#	0.5	11	37	9	N	3
DEC	-2	-19	-11	42	[illegible]	0.7	1.9	#	0.8	11	34	13	N	3
ANN	36	15	26	96	-62	10.9	6.2	#	3.4	6.6	43	13	N	4
EYR	22	22	22	22	22	22	22	22	22	22	22	22	22	22

Period of Record: May 1948 - May 1970
Source: 11th Weather Squadron, Elmendorf AFB, AK
Note: # indicates trace accumulations.
Climatic events measured and recorded at Fairbanks International Airport

TABLE D.8
TIN CITY AFS CLIMATOLOGICAL DATA

Month	Temperature		Rainfall Precipitation		Snowfall Precipitation		Wind	
	Mean Max(°F)	Mean Min(°F)	Mean (in)	Max (in)	Mean (in)	Max (in)	Mean Speed (kts)	Prevailing Direction
Jan.	6	-5	1.0	0.7	8	6	17	N
Feb.	-2	-13	1.0	1.2	9	7	19	N
Mar.	4	-8	1.0	1.0	7	5	18	N
Apr.	18	7	1.0	0.9	10	9	16	N
May	32	24	0.6	0.6	4	4	14	N
June	42	34	0.9	0.6	1	2	12	N
July	49	41	2.4	2.0	#	#	12	S
August	49	42	3.6	2.2	#	#	13	N
Sept.	42	36	3.7	1.8	5	9	13	N
Oct.	30	23	2.1	0.9	11	6	14	NNE
Nov.	17	8	1.2	0.4	11	4	17	NNE
Dec.	7	-4	0.9	0.6	9	6	17	N
Annual	25	15	19.4	2.2	75	9	15	N

APPENDIX E

MASTER LIST OF SHOPS

APPENDIX E
MASTER LIST OF SHOPS
AAC NORTHERN INSTALLATIONS

Name	Present Location (Bldg. No.)	Handles Hazardous Materials*	Generates Hazardous Waste*	Typical TSD Methods
Galena AFS				
Barrier Maintenance	1551	Yes	Yes	DPDO
Carpentry	1843	Yes	No	Consumed in Process
Composite Shop	1812	Yes	No	Consumed in Process
Interior/Exterior Electric	1551	Yes	No	Consumed in Process
Heat/Refrigeration	1842	Yes	Yes	Dust Control
Paint	1846	Yes	Yes	Off-Base Landfill
Power & Heating Plant	1499	Yes	Yes	DPDO, Off-Base Landfill
Vehicle/Equipment Maintenance	1845	Yes	Yes	DPDO, Off-Base Landfill
Aircraft Maintenace	1428	Yes	Yes	DPDO
Missile Maintenance	1488	Yes	Yes	DPDO, FPTA
AGE	1551	Yes	Yes	DPDO, FPTA
Electronics Equipment Maintenance	1551	Yes	Yes	DPDO
Fuels Lab	1837	Yes	Yes	Sanitary Sewer
Radar Maintenance	MAR Tower	Yes	Yes	DPDO

APPENDIX E
MASTER LIST OF SHOPS
AAC NORTHERN INSTALLATIONS
(CONTINUED)

Name	Present Location (Bldg. No.)	Handles Hazardous Materials*	Generates Hazardous Waste*	Typical TSD Methods
Campion AFS				
Note: Site Deactivated - Former shops were the same as other LRR sites and included Radar Maintenance, Radio Maintenance Power & Heating Plant, and Vehicle/Equipment Maintenance.				
Cape Lisburne AFS				
Vehicle Maintenance	150	Yes	Yes	DPDO
Power & Heating Plant	151	Yes	Yes	DPDO/Landfill
Radar Maintenance	300/301	Yes	Yes	Landfill
Radio Maintenance	300/301	No	No	---
Weather	---	No	No	---
Facility Maintenance**	150	Yes	Yes	Landfill
Alascom	---	No	No	---
Fort Yukon AFS				
Vehicle Maintenance	NCF	Yes	Yes	DPDO
Power & Heating Plant	NCF	Yes	Yes	DPDO
Radar Maintenance	106	Yes	Yes	DPDO
Radio Maintenance	106	No	No	---
Facility Maintenance**	NCF	Yes	No	Consumed In Process
Alascom	---	No	No	---

APPENDIX E
MASTER LIST OF SHOPS
AAC NORTHERN INSTALLATIONS
(CONTINUED)

Name	Present Location (Bldg. No.)	Handles Hazardous Materials*	Generates Hazardous Waste*	Typical TSD Methods
Indian Mountain AFS				
Vehicle Maintenance	NCF, 217	Yes	Yes	DPDO
Power Plant	NCF, 221	Yes	Yes	DPDO
Radar Maintenance	234	Yes	Yes	DPDO
Radio Maintenance	---	No	No	---
Weather	---	No	No	---
Facility Maintenance**	NCF	Yes	No	Consumed in Process
Alascom	---	No	No	---
Kotzebue AFS				
Radar Maintenance	201	Yes	Yes	DPDO
Radio Maintenance	201	No	No	---
Murphy Dome AFS				
Vehicle Maintenance	103/104	Yes	Yes	DPDO
Power & Heating Plant	110	Yes	Yes	DPDO
Radar Maintenance (USAF & FAA)	211/212	Yes	Yes	Dust Control/ DPDO
Weather	---	No	No	---

APPENDIX E
MASTER LIST OF SHOPS
AAC NORTHERN INSTALLATIONS
(CONTINUED)

Name	Present Location (Bldg. No.)	Handles Hazardous Materials*	Generates Hazardous Waste*	Typical TSD Methods
Facility Maintenance**	---	Yes	No	Consumed in Process
Alascom	---	No	No	---
Tin City AFS				
Vehicle Maintenance	150	Yes	Yes	Off-Base
Power & Heating Plant	110	Yes	Yes	Off-Base
Radar Maintenance	201/203	Yes	Yes	Off-Base
Radio Maintenance	201/203	No	No	---
Weather	---	No	No	---
Facility Maintenance**	150	Yes	No	Consumed in Process
Alascom	---	No	No	--

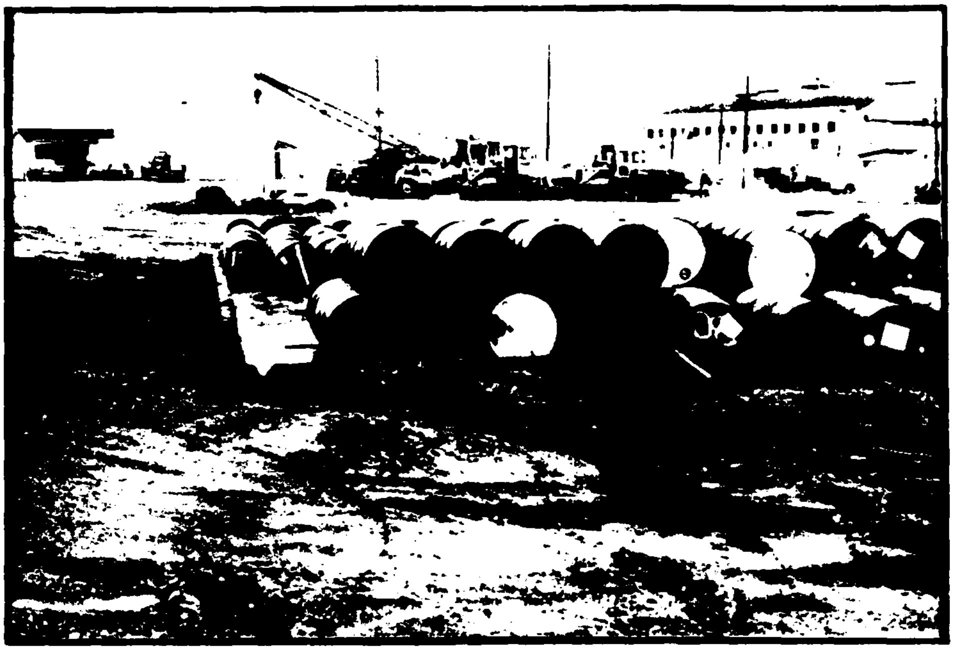
* See Section 4, pages 4-1 and 4-2 for definitions used in this report.
** Including such CE functions as electrical, carpentry, welding, refrigeration, painting, plumbing, etc.

NCF = New Composite Facility
TSD = Treatment, Storage, Disposal

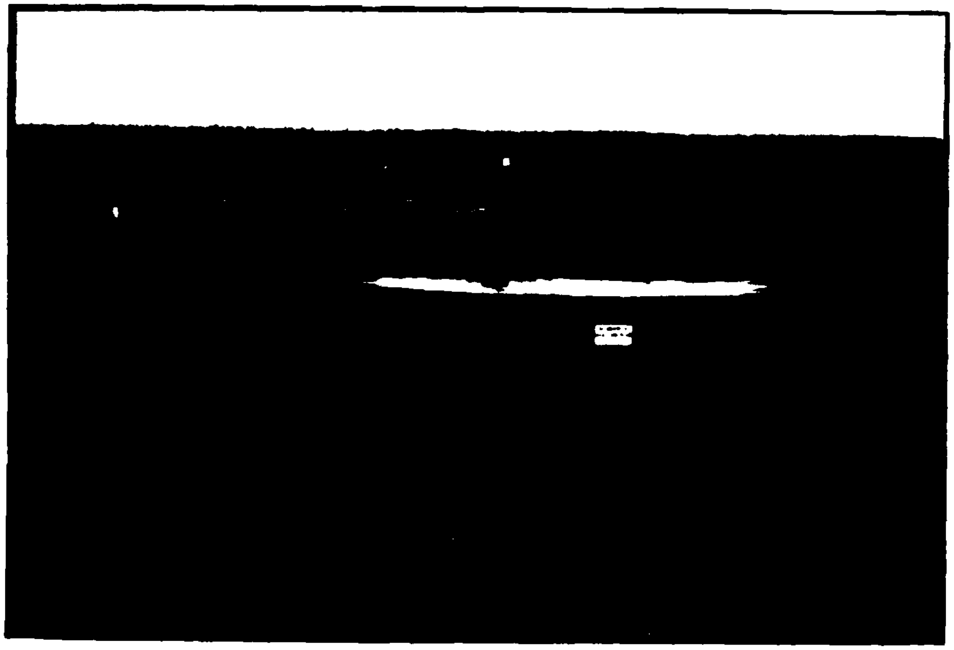
APPENDIX F

PHOTOGRAPHS

GALENA AFS
(1985)



Waste Accumulation Area
(FACING EAST)



Fire Protection Training Area
(FACING SOUTH)

GALENA AFS
(1985)

Landfill–Off Installation
(FACING SOUTHWEST)

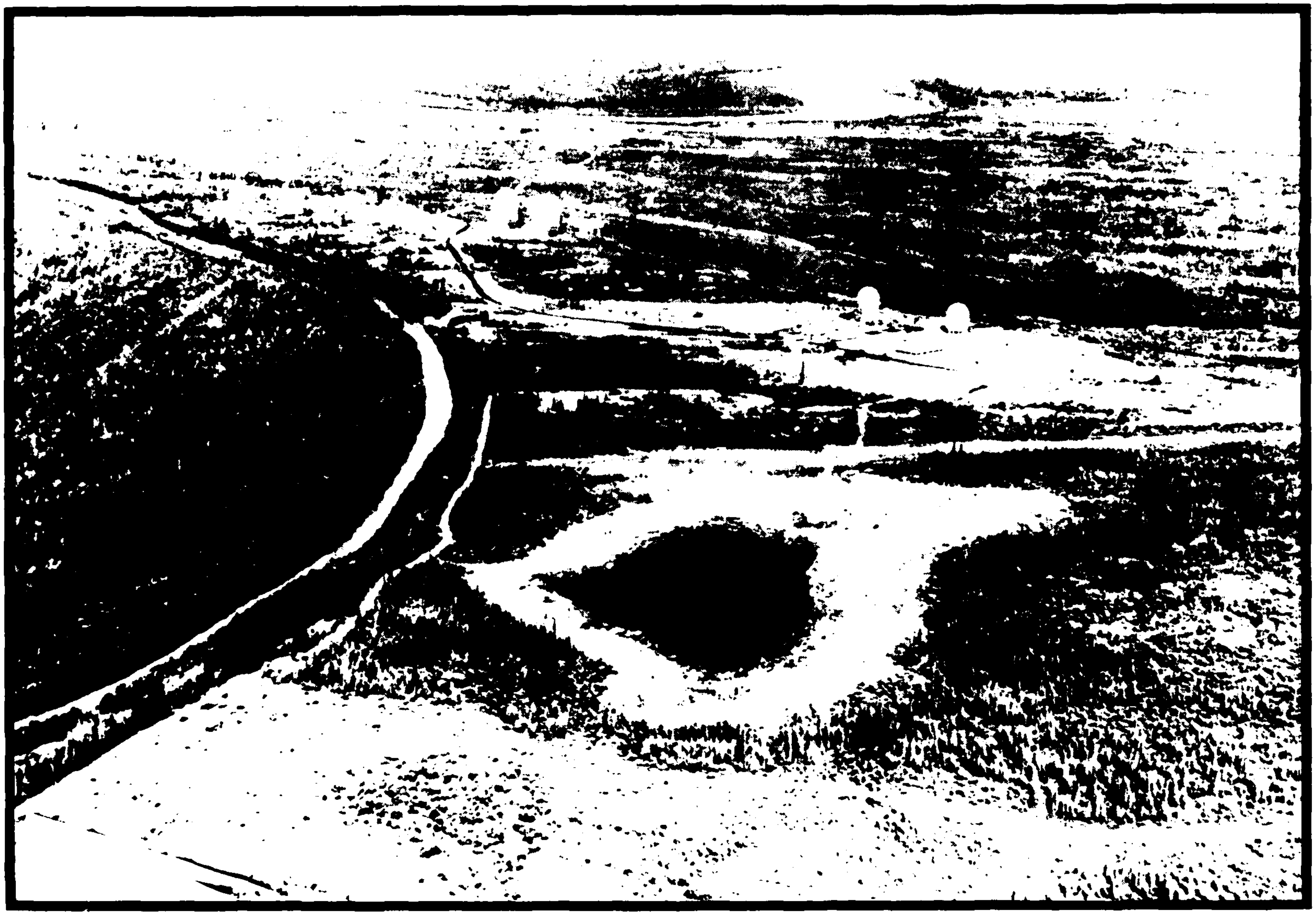
Crushed Empty Drum Pile–Off Installation
(FACING NORTHEAST)

CAPE LISBURNE AFS
(1985)

Landfill
(FACING SOUTHEAST)

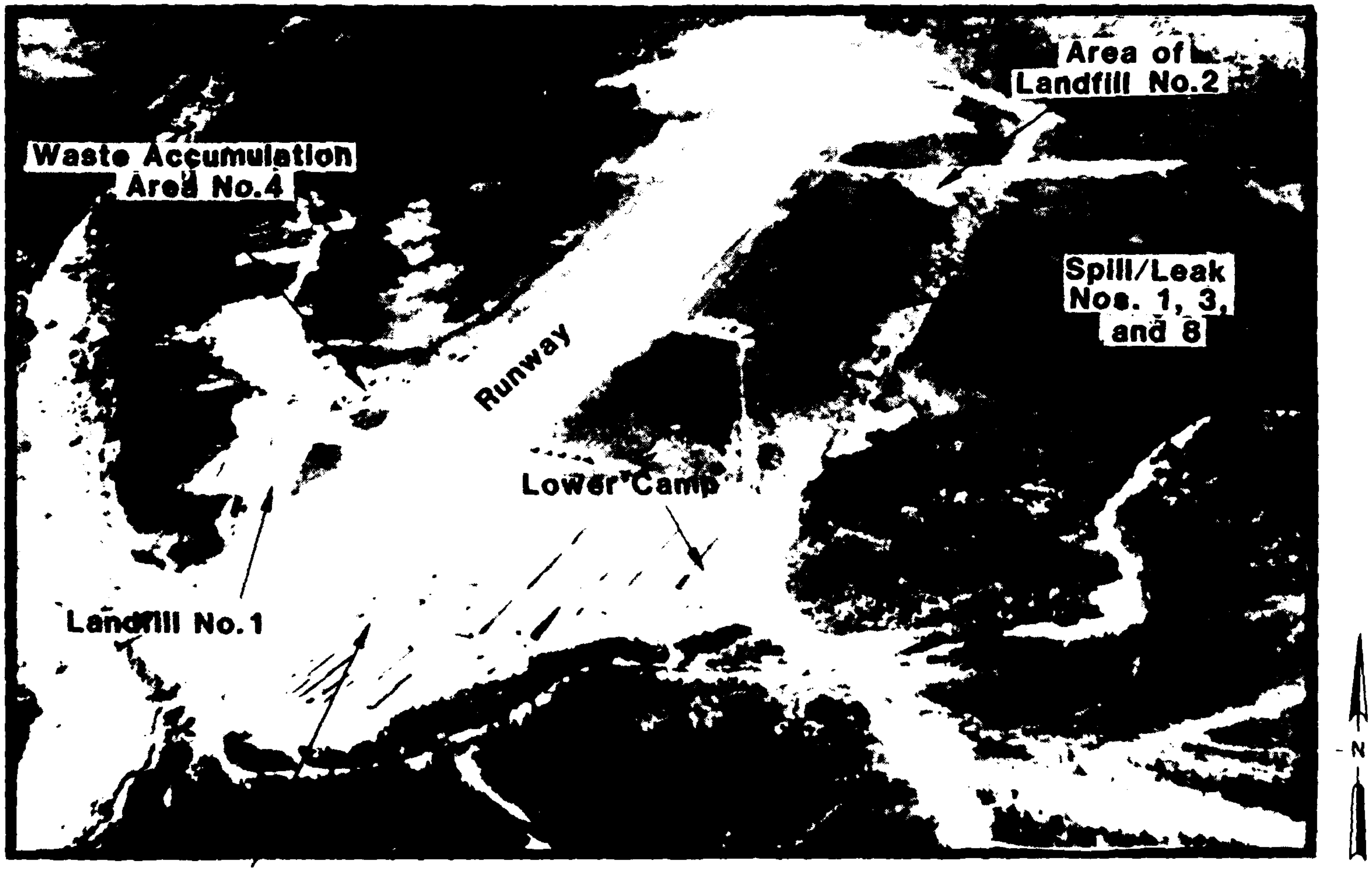
Landfill
(FACING NORTH)

FORT YUKON AFS
(UNDATED)



SOURCE: SELKREGG (1976c)   (Facing Northwest)

INDIAN MOUNTAIN AFS
(1961)



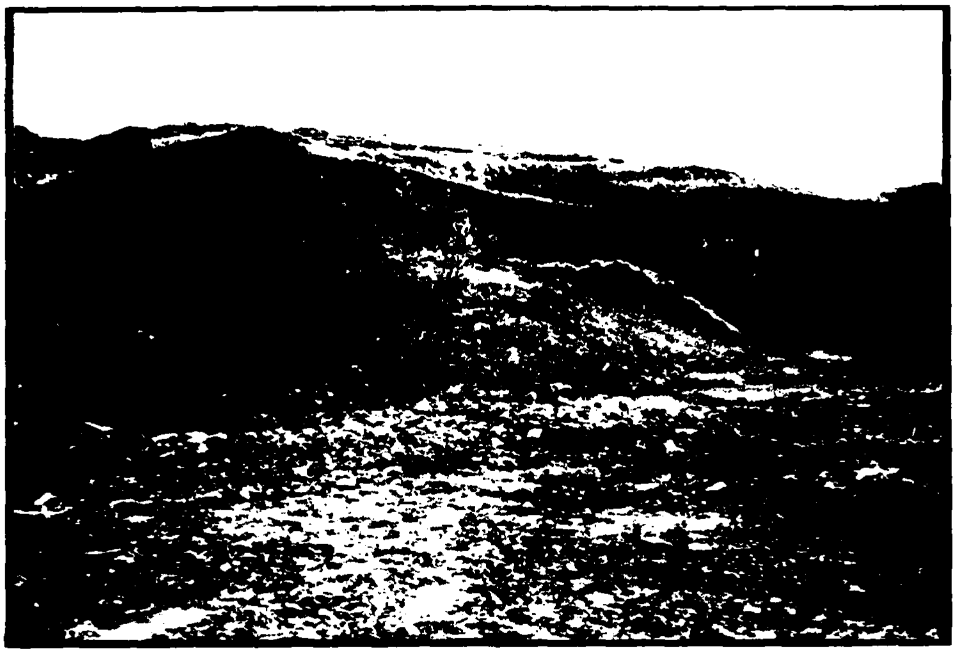
Waste Accumulation
Area No.1

INDIAN MOUNTAIN AFS
(1985)

Waste Accumulation Area No.1
(FACING NORTHWEST)

Near Waste Accumulation Area No.4
and Landfill No.4
(FACING SOUTH)

INDIAN MOUNTAIN AFS
(1985)

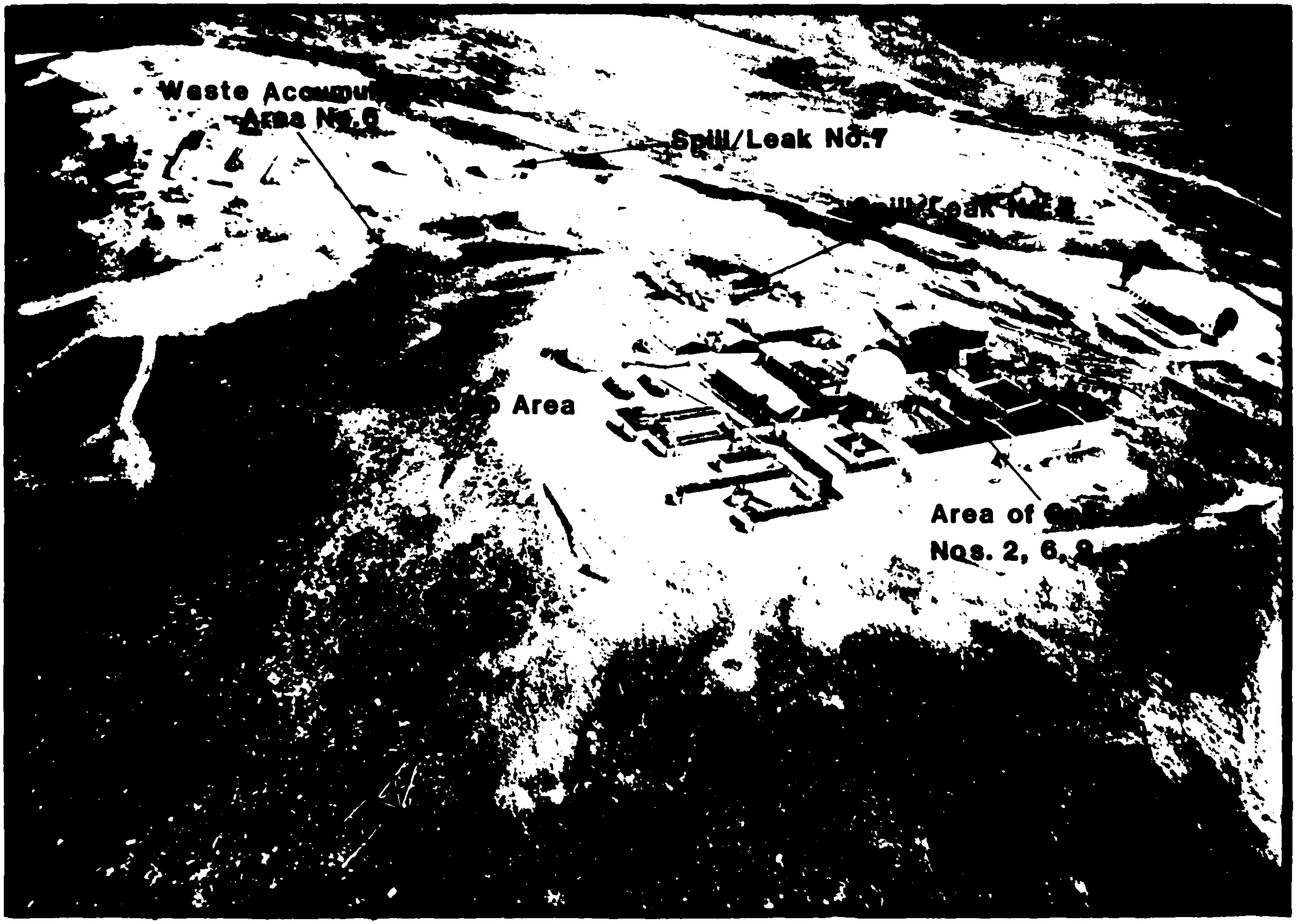


Landfill No.1
(FACING NORTHEAST)

Landfill No.2
(FACING SOUTH)

ES ENGINEERING-SCIENCE

INDIAN MOUNTAIN AFS
(UNDATED)



N

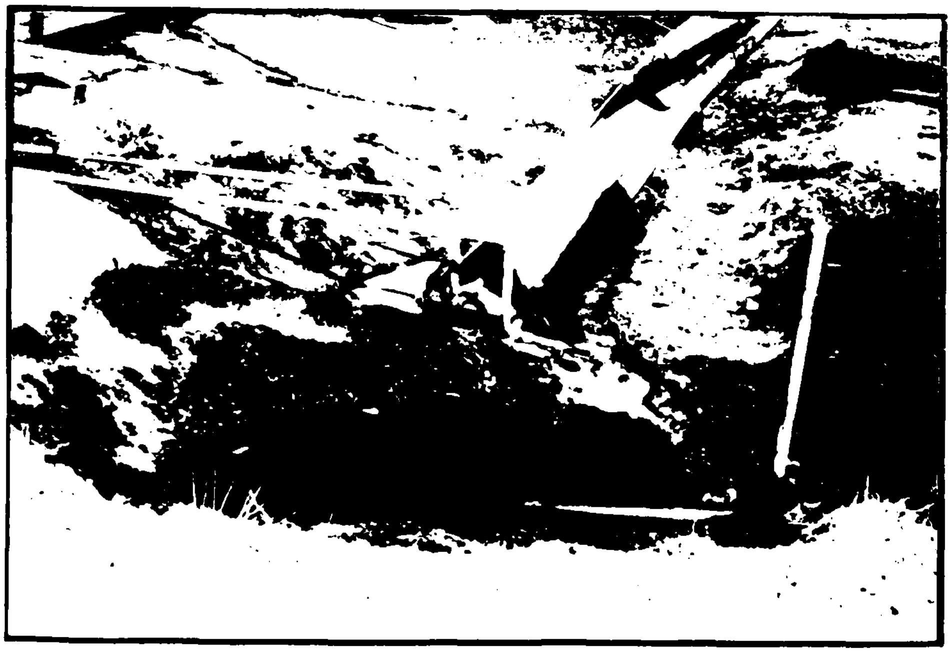
INDIAN MOUNTAIN AFS
(1985)

POL Tank No.2 and Spill/Leak
Site No. 7
(FACING SOUTH)

Dump Area
(FACING SOUTHEAST)

KOTZEBUE AFS
(1985)

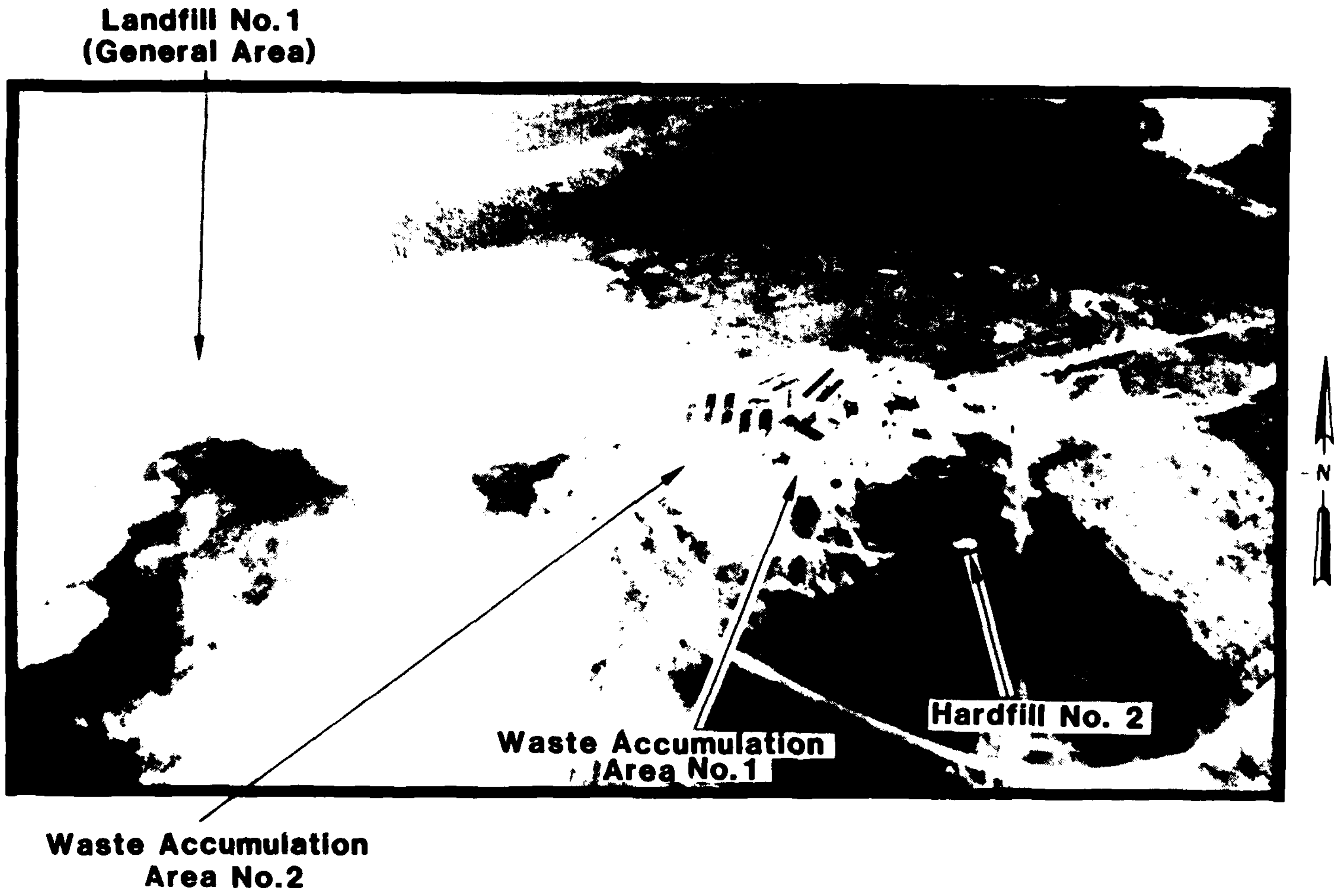
Fuel Leak/Spill No.3
(FACING SOUTH)



Fuel Leak/Spill No.3
(FACING EAST)

MURPHY DOME AFS

(1966)



MURPHY DOME AFS
(1985)

Landfill No.1
(FACING EAST)

Landfill No.2–Off Installation
(FACING NORTHEAST)

TIN CITY AFS
(1985)

Landfill
(FACING EAST)

Waste Accumulation Area
(FACING NORTHWEST)

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM

HAZARD ASSESSMENT RATING METHODOLOGY

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM

HAZARD ASSESSMENT RATING METHODOLOGY

BACKGROUND

The Department of Defense (DOD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practices at DOD facilities. One of the actions required under this program is to:

> "develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts." (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further actions at sites based upon information gathered during the Records Search phase of its Installation Restoration Program (IRP).

The first site rating model was developed in June 1981 at a meeting with represenatives from USAF Occupational and Environmental Health Laboratory (OEHL), Air Force Engineering and Services Center (AFESC), Engineering-Science (ES) and CH2M Hill. The basis for this model was a system developed for EPA by JRB Associates of McLean, Virginia. The JRB model was modified to meet Air Force needs.

After using this model for 6 months at over 20 Air Force installations, certain inadequacies became apparent. Therefore, on January 26 and 27, 1982, representatives of USAF OEHL, AFESC, various major commands, Engineering-Science, and CH2M Hill met to address the inadequacies. The result of the meeting was a new site rating model designed to present a better picture of the hazards posed by sites at Air Force installations. The new rating model described in this presentation is referred to as the Hazard Assessment Rating Methodology.

PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air Force in setting priorities for follow-on site investigations and confirmation work under Phase II of the IRP.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site can be deleted from consideration for rating on either basis.

DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DOD program needs.

The model uses data readily obtained during the Records Search portion (Phase I) of the IRP. Scoring judgments and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards at the site. This approach meshes well with the policy for evaluating and setting restrictions on excess DOD properties.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: the possible receptors of the contamination, the waste and its characteristics, potential pathways for waste contaminant migration, and any efforts to contain the contaminants. Each of these categories contains a number of rating factors that are used in the overall hazard rating.

The receptors category rating is calculated by scoring each factor, multiplying by a factor weighting constant and adding the weighted scores to obtain a total category score.

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned and for direct evidence, 100 points are assigned. If no evidence is found, the highest score among three possible routes is used. These routes are surface water migration, flooding, and ground-water migration. Evaluation of each route involves factors associated with the particular migration route. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The waste characteristics category is scored in three steps. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score, while scores for sludges and solids are reduced.

The scores for each of the three categories are then added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Sites at which there is no containment are not reduced in score. Scores for sites with limited containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the scores for the other three categories.

FIGURE 1

HAZARD ASSESSMENT RATING METHODOLOGY FLOW CHART

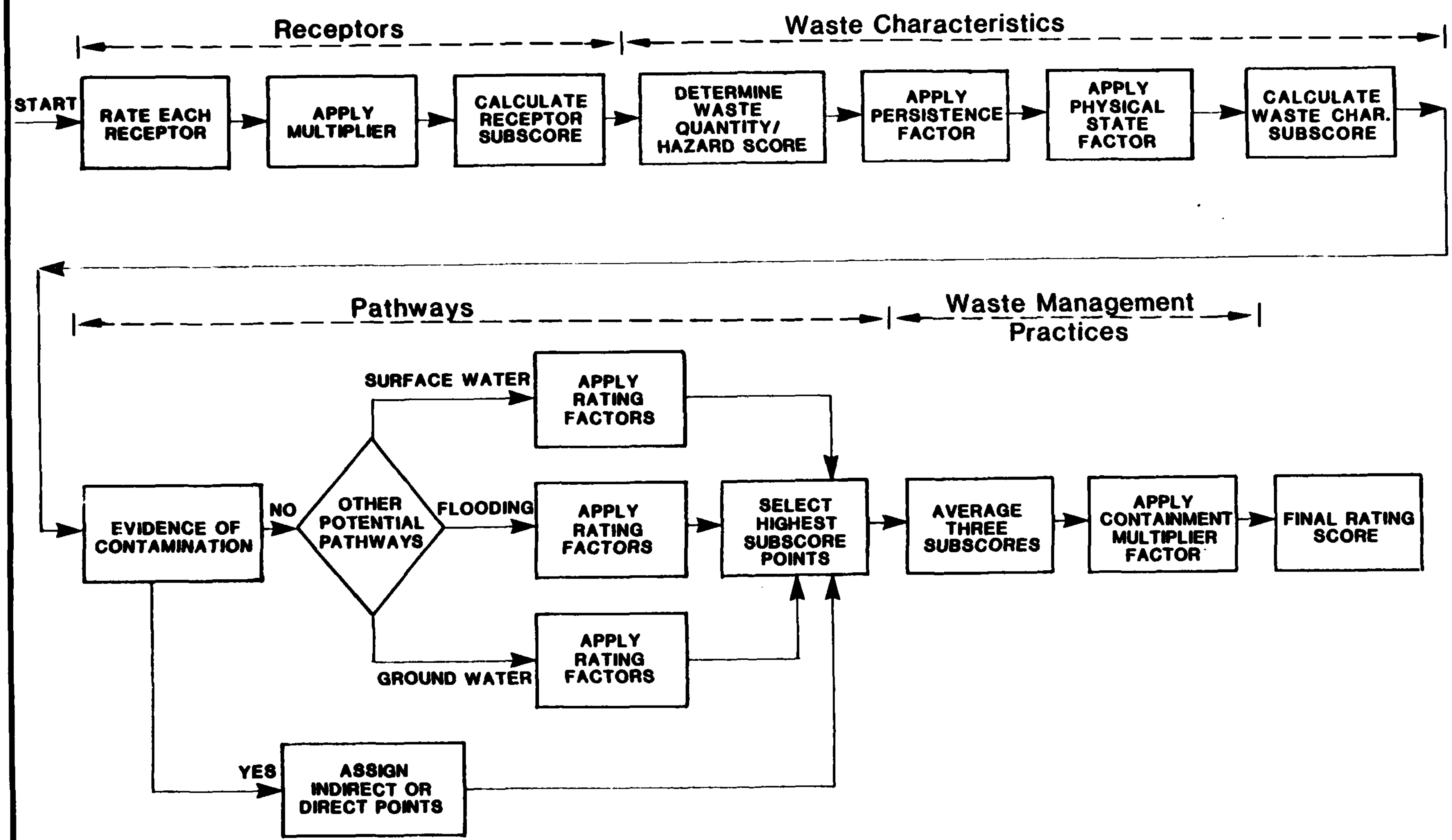


FIGURE 2

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE ______________________________

LOCATION ______________________________

DATE OF OPERATION OR OCCURRENCE ______________________________

OWNER/OPERATOR ______________________________

COMMENTS/DESCRIPTION ______________________________

SITE RATED BY ______________________________

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site		4		
B. Distance to nearest well		10		
C. Land use/zoning within 1 mile radius		3		
D. Distance to reservation boundary		6		
E. Critical environments within 1 mile radius of site		10		
F. Water quality of nearest surface water body		6		
G. Ground water use of uppermost aquifer		9		
H. Population served by surface water supply within 3 miles downstream of site		6		
I. Population served by ground-water supply within 3 miles of site		6		
		Subtotals	______	______

Receptors subscore (100 X factor score subtotal/maximum score subtotal) ______

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) ______
2. Confidence level (C = confirmed, S = suspected) ______
3. Hazard rating (H = high, M = medium, L = low) ______

Factor Subscore A (from 20 to 100 based on factor score matrix) ______

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

______ X ______ = ______

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

______ X ______ = ______

FIGURE 2 (Continued)

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		
		Subtotals	______	______

Subscore (100 X factor score subtotal/maximum score subtotal) ______

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding		1		

Subscore (100 x factor score/3) ______

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water		8		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		8		
Direct access to ground water		8		
		Subtotals	______	______

Subscore (100 x factor score subtotal/maximum score subtotal) ______

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

______ X ______ = ______

TABLE 1

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels: 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1 - 25	26 - 100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land Use/Zoning (within 1 mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or Industrial	Residential	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E. Critical environments (within 1 mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination.	Major habitat of an endangered or threatened species; presence of recharge area; major wetlands.	10
F. Water quality/use designation of nearest surface water body	Agricultural or Industrial use.	Recreation, propagation and management of fish and wildlife.	Shellfish propagation and harvesting.	Potable water supplies	6
G. Ground-Water use of uppermost aquifer	Not used, other sources readily available.	Commercial, industrial, or irrigation, very limited other water sources.	Drinking water, municipal water available.	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available.	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1 - 50	51 - 1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1 - 50	51 - 1,000	Greater than 1, 000	6

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (<5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (>20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- o Verbal reports from interviewer (at least 2) or written information from the records.
- o Knowledge of types and quantities of wastes generated by shops and other areas on base.
- o Based on the above, a determination of the types and quantities of waste disposed of at the site.

S = Suspected confidence level

- o No verbal reports or conflicting verbal reports and no written information from the records.
- o Logic based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site.

A-3 Hazard Rating

Hazard Category	Rating Scale Levels 0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°F	Flash point at 80°F to 140°F	Flash point less than 80°F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

II. WASTE CHARACTERISTICS (Continued)

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
80	L	C	M
	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
50	L	S	M
	L	C	L
	M	S	H
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	M
20	S	S	L

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:
Confidence Level
- o Confirmed confidence levels (C) can be added
- o Suspected confidence levels (S) can be added
- o Confirmed confidence levels cannot be added with suspected confidence levels

Waste Hazard Rating
- o Wastes with the same hazard rating can be added
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical State	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be directly confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

B-1 POTENTIAL FOR SURFACE WATER CONTAMINATION

Rating Factor	Rating Scale Levels 0	1	2	3	Multiplier
Distance to nearest surface water (includes drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 in.	-10 to + 5 in.	+5 to +20 in.	Greater than +20 in.	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($<10^{-6}$ cm/sec)	6
Rainfall intensity based on 1 year 24-hr rainfall	<1.0 inch	1.0-2.0 inches	2.1-3.0 inches	>3.0 inches	8

B-2 POTENTIAL FOR FLOODING

Rating Factor	0	1	2	3	Multiplier
Floodplain	Beyond 100-year floodplain	In 25-year floodplain	In 10-year floodplain	Floods annually	1

B-3 POTENTIAL FOR GROUND-WATER CONTAMINATION

Rating Factor	0	1	2	3	Multiplier
Depth to ground water	Greater than 500 ft	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 in.	-10 to +5 in.	+5 to +20 in.	Greater than +20 in.	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($<10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground-water level	8
Direct access to ground water (through faults, fractures, faulty well casings, subsidence fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. WASTE MANAGEMENT PRACTICES FACTOR

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Fire Proection Training Areas:

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1 or III-B-3, then leave blank for calculation of factor score and maximum possible score.

APPENDIX H

SITE HAZARD ASSESSMENT RATING FORMS

APPENDIX H

SITE HAZARD ASSESSMENT RATING FORMS

H.1 GALENA AFS

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Galena AFS : Waste Accumulation Area
Location: South of power plant
Date of Operation: 1950's to present
Owner/Operator: U.S.Air Force
Comments/Description: Spills and leaks of stored wastes, primarily POL

Site Rated by: J.R.Absalon; R.M.Palazzolo; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			156	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 87

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) M = medium
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.90 = 72

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

72 x 1.00 = 72

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 80

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 80

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	87		
Waste Characteristics	72		
Pathways	80		
Total 239	divided by 3 =	80	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

80 x 1.00 = 80

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Galena AFS : Spill / Leak No.1
Location: Between runway and Building 1403
Date of Operation: 1940's to 1960's
Owner/Operator: U.S.Air Force
Comments/Description: Disposal of residual POL and other products on the ground

Site Rated by: J.R.Absalon; R.M.Palazzolo; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			156	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 87

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) L = large
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 0.90 = 90

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

90 x 1.00 = 90

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		87
Waste Characteristics		90
Pathways		48
Total	225	divided by 3 = 75 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

75 x 1.00 = 75

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Galena AFS : Spill / Leak No.2
Location: Near Building 1403
Date of Operation: Mid 1950's
Owner/Operator: U.S.Air Force
Comments/Description: POL pipeline leak

Site Rated by: J.R.Absalon; R.M.Palazzolo; R.L Theom

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			156	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 87

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) L = large
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 0.90 = 90

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

90 x 1.00 = 90

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		87
Waste Characteristics		90
Pathways		48
Total	225 divided by 3 =	75 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

75 x 1.00 = 75

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Galena AFS : POL Tank Farm and Spill/Leak Nos.4 & 5
Location: Northeast of fire station near northern airport boundary
Date of Operation: 1950's to present; 1985,1980's
Owner/Operator: U.S.Air Force
Comments/Description: POL spills and leaks, drainage of water/fuel, POL tank sludge disposal
Site Rated by: J.R.Absalon; R.M.Palazzolo; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			156	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 87

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) M = medium
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.90 = 72

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

72 x 1.00 = 72

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore = 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	87	
Waste Characteristics	72	
Pathways	48	
Total 207	divided by 3 =	69 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

69 x 1.00 = 69

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Galena AFS : Fire Protection Training Area
Location: Northeast corner of the airport
Date of Operation: Late 1950's to present
Owner/Operator: U.S.Air Force
Comments/Description: Burned fuels and shop wastes

Site Rated by: J.R.Absalon; R.M.Palazzolo; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			156	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 87

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) M = medium
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.90 = 72

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

72 x 1.00 = 72

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	87	
Waste Characteristics	72	
Pathways	48	
Total 207	divided by 3 =	69 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

69 x 1.00 = 69

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Galena AFS : Spill / Leak No.3
Location: South flood control dike near cool barge landing site
Date of Operation: 1984
Owner/Operator: U.S.Air Force
Comments/Description: POL loss from truck accident

Site Rated by: J.R.Absalon; R.M.Palazzolo; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			156	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 87

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		87	
Waste Characteristics		54	
Pathways		48	
Total	189	divided by 3 =	63 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

63 x 1.00 = 63

FINAL SCORE

H.2 CAMPION AFS

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Campion AFS : Landfill No.1
Location: Approximately 1.5 miles south of camp on both sides of road
Date of Operation: 1950's to mid 1970's
Owner/Operator: U.S.Air Force
Comments/Description: Disposal of some shop wastes

Site Rated by: J.R.Absalon; R.M.Palazzolo; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			103	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 57

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) M = medium
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.90 = 72

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

72 x 1.00 = 72

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			30	114
Subscore (100 x factor score subtotal/maximum score subtotal)				26

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	57	
Waste Characteristics	72	
Pathways	48	
Total 177	divided by 3 =	59 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

59 x 1.00 = \ 59 \
FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Campion AFS : Spill / Leak No.1
Location: Bulk POL storage area
Date of Operation: 1950's to 1983
Owner/Operator: U.S.Air Force
Comments/Description: POL spills and leaks

Site Rated by: J.R.Absalon; R.M.Palazzolo; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			117	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 65

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			30	114
Subscore (100 x factor score subtotal/maximum score subtotal)				26

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		65		
Waste Characteristics		54		
Pathways		48		
Total	167	divided by 3 =	56	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

56 x 1.00 = \ 56 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Campion AFS : Waste Accumulation Area No.2
Location: Southeast corner of camp
Date of Operation: 1950's to 1983
Owner/Operator: U.S.Air Force
Comments/Description: Spills and leaks from stored wastes and products

Site Rated by: J.R.Absalon; R.M.Palazzolo; R.L Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			117	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 65

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			30	114
Subscore (100 x factor score subtotal/maximum score subtotal)				26

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	65		
Waste Characteristics	54		
Pathways	48		
Total 167 divided by 3 =		56	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

56 x 1.00 = 56

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Campion AFS : Landfill No.2
Location: Approximately 0.5 mile southeast of camp on southwest side of road
Date of Operation: Mid 1970's to 1983
Owner/Operator: U.S.Air Force
Comments/Description: Disposal of some shop wastes

Site Rated by: J.R.Absalon; R.M.Palazzolo; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			117	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 65

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			30	114
Subscore (100 x factor score subtotal/maximum score subtotal)				26

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		65	
Waste Characteristics		54	
Pathways		48	
Total	167	divided by 3 =	56 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

56 x 1.00 = \ 56 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Campion AFS : Spill / Leak No.2
Location: Northwest corner of installation near cool barge landing site
Date of Operation: 1950's to 1983
Owner/Operator: U.S.Air Force
Comments/Description: Spills and leaks from stored products

Site Rated by: J.R.Absalon; R.M.Palazzolo; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			107	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 59

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			30	114
Subscore (100 x factor score subtotal/maximum score subtotal)				26

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	59		
Waste Characteristics	54		
Pathways	48		
Total 161	divided by 3 =	54	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

54 x 1.00 = 54 FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Campion AFS : Waste Accumulation Area No.1
Location: Approximately 0.25 mile southeast of station on southwest side of road
Date of Operation: 1950's to 1983
Owner/Operator: U.S.Air Force
Comments/Description: Spills and leaks from stored wastes and products

Site Rated by: J.R.Absalon; R.M.Palazzolo; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			107	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 59

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			30	114
Subscore (100 x factor score subtotal/maximum score subtotal)				26

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		59	
Waste Characteristics		54	
Pathways		48	
Total	161	divided by 3 =	54 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

54 x 1.00 = \ 54 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Campion AFS : White Alice Site
Location: North of camp near south end of runway
Date of Operation: 1958 to 1978
Owner/Operator: U.S. Air Force
Comments/Description: Spills and leaks of oil with PCB

Site Rated by: J.R. Absalon; R.M. Palazzolo; R.L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi- plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			107	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 59

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) S = suspected
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 1.00 = 40

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.00 = 40

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			30	114
Subscore (100 x factor score subtotal/maximum score subtotal)				26

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		59		
Waste Characteristics		40		
Pathways		48		
Total	147	divided by 3 =	49	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

49 x 1.00 = 49

FINAL SCORE

H.3 CAPE LISBURNE AFS

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Cape Lisburne LRR : Fuel Spill / Leak No.1
Location: East of Building 151 , Lower Camp
Date of Operation: 1980
Owner/Operator: U.S.Air Force
Comments/Description: Fuel tank was overfilled , resulting in spill of 3,000 gallons of diesel fuel
Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			142	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 79

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) M = medium
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.90 = 72

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

72 x 1.00 = 72

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	1	8	8	24
Subtotals			38	108
Subscore (100 x factor score subtotal/maximum score subtotal)				35
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to ground water	3	8	24	24
Subtotals			70	114
Subscore (100 x factor score subtotal/maximum score subtotal)				61

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 61

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		79
Waste Characteristics		72
Pathways		61
Total	212	divided by 3 = 71 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

71 x 1.00 = \ 71 \
FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name Of Site: Cape Lisburne LRR : Dump No. 2
Location: Valley South of Upper Camp
Date of Operation: 1953 to 1977
Owner/Operator: U.S. Air Force
Comments/Description: Refuse, scrap metal, and POL wastes disposed of off top of mountain
Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			119	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 66

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard; and the confidence level of the information.

1. Waste quantity (small, medium, or large) M = medium
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.90 = 72

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

72 x 1.00 = 72

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	3	8	24	24
Surface permeability	0	6	0	18
Rainfall intensity	1	8	8	24
Subtotals			62	108
Subscore (100 x factor score subtotal/maximum score subtotal)				57
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to ground water	3	8	24	24
Subtotals			70	114
Subscore (100 x factor score subtotal/maximum score subtotal)				61

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 61

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	66		
Waste Characteristics	72		
Pathways	61		
Total 200	divided by 3 =	67	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

67 x 1.00 = \ 67 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Cape Lisburne LRR : Fuel Spill / Leak No. 2
Location: Runway apron at Lower Camp
Date of Operation: 1982
Owner/Operator: U.S. Air Force
Comments/Description: 1,500 gallons of AVGAS spilled when bladder ruptured

Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			118	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 66

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) M = medium
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.90 = 72

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

72 x 1.00 = 72

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	1	8	8	24
Subtotals			38	108
Subscore (100 x factor score subtotal/maximum score subtotal)				35
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to ground water	3	8	24	24
Subtotals			70	114
Subscore (100 x factor score subtotal/maximum score subtotal)				61

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 61

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		66
Waste Characteristics		72
Pathways		61
Total	199	divided by 3 = 66 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

66 x 1.00 = 66

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Cape Lisburne LRR :Landfill No.1 & Waste Accumulation Area No.2/Dump No.1
Location: East of main installation along Chukchi Sea , Lower Camp
Date of Operation: 1953 to present
Owner/Operator: U.S.Air Force
Comments/Description: Landfill has received waste oils, chlorinated solvents.
Dump was used for accumulation of POL wastes
Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			138	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 77

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	1	8	8	24
Subsurface flows	2	8	16	24
Direct access to ground water	1	8	8	24
Subtotals			54	114
Subscore (100 x factor score subtotal/maximum score subtotal)				47

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		77		
Waste Characteristics		54		
Pathways		56		
Total	187	divided by 3 =	62	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

62 x 1.00 = 62

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Cape Lisburne LRR : Runway Oiling
Location: Aircraft runway , Lower Camp
Date of Operation: 1953 to late 1970's
Owner/Operator: U.S.Air Force
Comments/Description: Oiling of the runway is suspected as a disposal method

Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			142	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 79

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) S = suspected
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 0.90 = 36

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

36 x 1.00 = 36

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			44	108
Subscore (100 x factor score subtotal/maximum score subtotal)				41
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 41

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		79
Waste Characteristics		36
Pathways		41
Total	156	divided by 3 = 52 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

52 x 1.00 = 52

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Cape Lisburne LRR : White Alice Site
Location: Adjacent to Upper Camp
Date of Operation: 1957 to 1979
Owner/Operator: U.S.Air Force
Comments/Description: Suspected PCB contamination fom disposal of oil on ground

Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			119	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 66

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) S = suspected
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 1.00 = 40

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.00 = 40

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	0	6	0	18
Rainfall intensity	1	8	8	24
Subtotals			38	108
Subscore (100 x factor score subtotal/maximum score subtotal)				35
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 40

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		66	
Waste Characteristics		40	
Pathways		40	
Total	146	divided by 3 =	49 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

49 x 1.00 = 49

FINAL SCORE

H.4 FORT YUKON AFS

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Fort Yukon LRR : Road Oiling
Location: Installation Road System
Date of Operation: 1958 to 1984
Owner/Operator: U.S.Air Force
Comments/Description: Oiling of roads for dust control and waste disposal

Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			148	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 82

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			38	114
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		82	
Waste Characteristics		54	
Pathways		48	
Total	184	divided by 3 =	61 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

61 x 1.00 = \ 61 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Fort Yukon LRR : Waste Accumulation Area
Location: South of POL tanks and East of new composite facility
Date of Operation: 1958 to present
Owner/Operator: U.S.Air Force
Comments/Description: Accumulation area used for long period of time with potential for spills and leaks
Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			148	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 82

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			44	108
Subscore (100 x factor score subtotal/maximum score subtotal)				41
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			38	114
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 41

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	82	
Waste Characteristics	54	
Pathways	41	
Total 177 divided by 3 =		59 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

59 x 1.00 = \ 59 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Fort Yukon LRR : Landfill No. 1
Location: Eastern installation boundary
Date of Operation: 1958 to early 1970's
Owner/Operator: U.S.Air Force
Comments/Description: Landfill for disposal of garbage, refuse and shop wastes.

Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			144	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 80

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			44	108
Subscore (100 x factor score subtotal/maximum score subtotal)				41
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. *Ground-water migration*				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			38	114
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 41

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		80	
Waste Characteristics		54	
Pathways		41	
Total	175	divided by 3 =	58 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

58 x 1.00 = 58

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Fort Yukon LRR ; Oil/ Fuel Discharge
Location: Northwest corner of old composite facility
Date of Operation: 1958 to 1984
Owner/Operator: U.S.Air Force
Comments/Description: Waste oil and diesel fuel drained from floor of power plant to ground
Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi- plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			148	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 82

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			36	108
Subscore (100 x factor score subtotal/maximum score subtotal)				33
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			38	114
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 33

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		82	
Waste Characteristics		54	
Pathways		33	
Total	169	divided by 3 =	56 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

56 x 1.00 = 56

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Fort Yukon LRR : White Alice Site
Location: West of main installation
Date of Operation: 1958 to 1980
Owner/Operator: U.S.Air Force
Comments/Description: Suspected PCB contamination from disposal of oil on ground

Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi- plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			144	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 80

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) S = suspected
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 1.00 = 40

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.00 = 40

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			44	108
Subscore (100 x factor score subtotal/maximum score subtotal)				41
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			38	114
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 41

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		80		
Waste Characteristics		40		
Pathways		41		
Total	161	divided by 3 =	54	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

54 x 1.00 = \ 54 \

FINAL SCORE

H.5 INDIAN MOUNTAIN AFS

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Indian Mountain LRR : Spill / Leak Nos. 1,3,8
Location: POL bulk storage area, Lower Camp
Date of Operation: 1973; 1974; 1977
Owner/Operator: U.S.Air Force
Comments/Description: Spills and leaks of POL

Site Rated by: J.R.Absalon; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			142	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 79

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) L = large
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 0.90 = 90

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

90 x 1.00 = 90

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			68	108
Subscore (100 x factor score subtotal/maximum score subtotal)				63
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 63

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		79	
Waste Characteristics		90	
Pathways		63	
Total	232	divided by 3 =	77 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

77 x 1.00 = 77

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Indian Mountain LRR : Waste Accumulation Area No.4 & Landfill Nos.3,4
Location: South of runway , Lower Camp
Date of Operation: 1950's to 1960's ; 1978 to 1980 ; 1970's
Owner/Operator: U.S.Air Force
Comments/Description: Spills and leaks (primarily POL) , burial of drums

Site Rated by: J.R.Absalon; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			142	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 79

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) M = medium
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.90 = 72

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

72 x 1.00 = 72

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			68	108
Subscore (100 x factor score subtotal/maximum score subtotal)				63
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 63

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		79
Waste Characteristics		72
Pathways		63
Total	214	divided by 3 = 71 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

71 x 1.00 = 71

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Indian Mountain LRR:Waste Accumulation Area No.6 & Spill/Leak Nos.2,5,6,7,9,10
Location: Notheast side of Upper Camp
Date of Operation: 1950's to late 1970's; 1973; 1977/78; 1977; 1979; 1979
Owner/Operator: U.S.Air Force
Comments/Description: Spills and leaks , primarily POL

Site Rated by: J.R.Absalon; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	0	10	0	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	1	6	6	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			79	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 44

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) L = large
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 0.90 = 90

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

90 x 1.00 = 90

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	2	8	16	24
Surface permeability	0	6	0	18
Rainfall intensity	3	8	24	24
Subtotals			70	108
Subscore (100 x factor score subtotal/maximum score subtotal)				65
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	1	6	6	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to ground water	3	8	24	24
Subtotals			78	114
Subscore (100 x factor score subtotal/maximum score subtotal)				68

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 68

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		44	
Waste Characteristics		90	
Pathways		68	
Total	202	divided by 3 =	67 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

67 x 1.00 = 67

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Indian Mountain LRR : Landfill No.1
Location: South of and near east end of runway , Lower Camp
Date of Operation: 1953 to 1977
Owner/Operator: U.S.Air Force
Comments/Description: Disposal of some shop wastes

Site Rated by: J.R.Absalon; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			142	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 79

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			68	108
Subscore (100 x factor score subtotal/maximum score subtotal)				63
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 63

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		79	
Waste Characteristics		54	
Pathways		63	
Total	196	divided by 3 =	65 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

65 x 1.00 = 65

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Indian Mountain LRR : Waste Accumulation Area No.1
Location: Near east end of runway ; Lower Camp
Date of Operation: 1950's to present
Owner/Operator: U.S.Air Force
Comments/Description: Spills and leaks from wastes and products stored

Site Rated by: J.R.Absalon; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			142	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 79

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			68	108
Subscore (100 x factor score subtotal/maximum score subtotal)				63
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 63

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		79	
Waste Characteristics		54	
Pathways		63	
Total	196	divided by 3 =	65 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

65 x 1.00 = 65

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Indian Mountain LRR : Waste Accumulation Area No.3 & Spill/Leak Nos.4,11
Location: Old power plant, Lower Camp
Date of Operation: 1950's to 1984; 1976; 1970's
Owner/Operator: U.S.Air Force
Comments/Description: Spills and leaks , primarily POL

Site Rated by: J.R.Absalon; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			142	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 79

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			68	108
Subscore (100 x factor score subtotal/maximum score subtotal)				63
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 63

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		79
Waste Characteristics		54
Pathways		63
Total	196	divided by 3 = 65 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

65 x 1.00 = 65

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Indian Mountain LRR : Waste Accumulation Area No.5
Location: North of road to Upper Camp , close to Lower Camp
Date of Operation: 1960's to 1970's
Owner/Operator: U.S.Air Force
Comments/Description: Spills and leaks from wastes and products stored

Site Rated by: J.R.Absalon; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			142	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 79

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			68	108
Subscore (100 x factor score subtotal/maximum score subtotal)				63
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 63

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		79
Waste Characteristics		54
Pathways		63
Total	196 divided by 3 =	65 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

65 x 1.00 = 65

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Indian Mountain LRR : Road Oiling
Location: Lower Camp and Upper Camp roads
Date of Operation: 1950's to 1984
Owner/Operator: U.S.Air Force
Comments/Description: Disposal of waste oils and other shop wastes on roads

Site Rated by: J.R.Absalon; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			142	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 79

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			68	108
Subscore (100 x factor score subtotal/maximum score subtotal)				63
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 63

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	79		
Waste Characteristics	54		
Pathways	63		
Total	196 divided by 3 =	65	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

65 x 1.00 = 65

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Indian Mountain LRR : Dump Areas
Location: Northwest and east sides of Upper Camp mountain
Date of Operation: 1950's to late 1970's
Owner/Operator: U.S. Air Force
Comments/Description: Dumping of drums and other materials from shops

Site Rated by: J.R. Absalon; R.L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	0	10	0	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	1	6	6	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			79	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 44

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) M = medium
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.90 = 72

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

72 x 1.00 = 72

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	2	8	16	24
Surface permeability	0	6	0	18
Rainfall intensity	3	8	24	24
Subtotals			70	108
Subscore (100 x factor score subtotal/maximum score subtotal)				65
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	1	6	6	18
Soil permeability	3	8	24	24
Subsurface flows	1	8	8	24
Direct access to ground water	3	8	24	24
Subtotals			86	114
Subscore (100 x factor score subtotal/maximum score subtotal)				75

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 75

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		44		
Waste Characteristics		72		
Pathways		75		
Total	191	divided by 3 =	64	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

64 x 1.00 = 64

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Indian Mountain LRR : Landfill No.2
Location: North of and near west end of runway , Lower Camp
Date of Operation: 1977 to present
Owner/Operator: U.S.Air Force
Comments/Description: Disposal of some shop wastes

Site Rated by: J.R.Absalon; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			125	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 69

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			68	108
Subscore (100 x factor score subtotal/maximum score subtotal)				63
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. *Highest pathway subscore.*

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 63

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		69	
Waste Characteristics		54	
Pathways		63	
Total	186	divided by 3 =	62 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

62 x 1.00 = 62

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Indian Mountain LRR : White Alice Site
Location: Southeast of Upper Camp
Date of Operation: 1958 to 1978
Owner/Operator: U.S.Air Force
Comments/Description: Spills, leaks, and disposal of oils with PCB

Site Rated by: J.R.Absalon; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	0	10	0	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	1	6	6	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			79	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 44

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) S = suspected
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 1.00 = 40

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.00 = 40

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	2	8	16	24
Surface permeability	0	6	0	18
Rainfall intensity	3	8	24	24
Subtotals			70	108
Subscore (100 x factor score subtotal/maximum score subtotal)				65
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	1	6	6	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to ground water	3	8	24	24
Subtotals			78	114
Subscore (100 x factor score subtotal/maximum score subtotal)				68

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 68

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		44
Waste Characteristics		40
Pathways		68
Total	152	divided by 3 = 51 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

51 x 1.00 = 51

FINAL SCORE

H.6 KOTZEBUE AFS

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Kotzebue LRR : Fuel Spill/Leak Nos. 1,2,3
Location: In vicinity of composite facility
Date of Operation: Mid 1970's, Late 1970's, 1984
Owner/Operator: U.S. Air Force
Comments/Description: Ground is stained with diesel fuel, fuel present in trenches southwest of composite facility
Site Rated by: J.R. Absalon; R.M. Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	0	10	0	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			64	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 36

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) L = large
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 0.90 = 90

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

90 x 1.00 = 90

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 100

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	NA	8	NA	24
Net precipitation	NA	6	NA	18
Surface erosion	NA	8	NA	24
Surface permeability	NA	6	NA	18
Rainfall intensity	NA	8	NA	24
Subtotals			0	108
Subscore (100 x factor score subtotal/maximum score subtotal)				0
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	NA	8	NA	24
Net precipitation	NA	6	NA	18
Soil permeability	NA	8	NA	24
Subsurface flows	NA	8	NA	24
Direct access to ground water	NA	8	NA	24
Subtotals			0	114
Subscore (100 x factor score subtotal/maximum score subtotal)				0

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 100

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		36		
Waste Characteristics		90		
Pathways		100		
Total	226	divided by 3 =	75	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

75 x 1.00 = \ 75 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Kotzebue LRR : Waste Accumulation Area No.2/Landfill No.1
Location: North of POL storage tanks on Kotzebue Sound
Date of Operation: Early 1950's to 1972
Owner/Operator: U.S.Air Force
Comments/Description: Suspected accumulation area for POL wastes and landfill which may have received shop wastes and waste POL
Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			88	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 49

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	1	8	8	24
Direct access to ground water	1	8	8	24
Subtotals			62	114
Subscore (100 x factor score subtotal/maximum score subtotal)				54

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 54

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		49
Waste Characteristics		54
Pathways		54
Total	157 divided by 3 =	52 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

52 x 1.00 = \ 52 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Kotzebue LRR : Road Oiling
Location: Installation Road System.
Date of Operation: Early 1950's to 1984
Owner/Operator: U.S.Air Force
Comments/Description: Oiling of roads for dust control and waste disposal

Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	1	6	6	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			92	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 51

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	1	6	6	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			38	114
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		51	
Waste Characteristics		54	
Pathways		48	
Total	153	divided by 3 =	51 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

51 x 1.00 = 51

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Kotzebue LRR : Waste Accumulation Area No. 1
Location: South of composite facility
Date of Operation: Early 1950's to present
Owner/Operator: U.S.Air Force
Comments/Description: Accumulation area used for long period of time with potential for spills and leaks
Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			92	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 51

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			44	108
Subscore (100 x factor score subtotal/maximum score subtotal)				41
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 41

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		51		
Waste Characteristics		54		
Pathways		41		
Total	146	divided by 3 =	49	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

49 x 1.00 = 49 FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Kotzebue LRR : White Alice Site
Location: North of main installation
Date of Operation: 1957 to 1979
Owner/Operator: U.S.Air Force
Comments/Description: Suspected PCB contamination from disposal of oil on ground

Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			92	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 51

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) S = suspected
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 1.00 = 40

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.00 = 40

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		51	
Waste Characteristics		40	
Pathways		48	
Total	139	divided by 3 =	46 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

46 x 1.00 = 46

FINAL SCORE

H.7 MURPHY DOME AFS

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Murphy Dome LRR : Road Oiling
Location: Installation roads
Date of Operation: 1950's to 1960's
Owner/Operator: U.S.Air Force
Comments/Description: Disposal of waste oils and other shop wastes on roads

Site Rated by: J.R.Absalon; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			122	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 68

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			38	114
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	68	
Waste Characteristics	54	
Pathways	48	
Total 170 divided by 3 =		57 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

57 x 1.00 = 57

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Murphy Dome LRR : Landfill No.2
Location: Approximately 6 miles southeast on the north side of access road to station
Date of Operation: 1970's to 1977
Owner/Operator: U.S.Air Force
Comments/Description: Disposal of some shop wastes

Site Rated by: J.R.Absalon; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	1	6	6	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			115	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 64

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. *Ground-water migration*				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			38	114
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		64
Waste Characteristics		54
Pathways		48
Total	166	divided by 3 = 55 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

55 x 1.00 = \ 55 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Murphy Dome LRR : Landfill No.1
Location: On trail about 0.5 mile northwest of helicopter landing area
Date of Operation: 1950's to early 1970's
Owner/Operator: U.S.Air Force
Comments/Description: Disposal of some shop wastes

Site Rated by: J.R.Absalon; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			116	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 64

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	1	8	8	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			36	108
Subscore (100 x factor score subtotal/maximum score subtotal)				33
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			30	114
Subscore (100 x factor score subtotal/maximum score subtotal)				26

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 33

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	64		
Waste Characteristics	54		
Pathways	33		
Total 151	divided by 3 =	50	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

50 x 1.00 = 50

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Murphy Dome LRR : Waste Accumulation Area No.1 & Bulk POL Storage Area:Spills
Location: Adjacent to and with bulk POL storage area
Date of Operation: 1960's to present , 1970 to 1981
Owner/Operator: U.S.Air Force
Comments/Description: Spills and leaks , primarily POL

Site Rated by: J.R.Absalon; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			116	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 64

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	1	8	8	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			36	108
Subscore (100 x factor score subtotal/maximum score subtotal)				33
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			30	114
Subscore (100 x factor score subtotal/maximum score subtotal)				26

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 33

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		64	
Waste Characteristics		54	
Pathways		33	
Total	151	divided by 3 =	50 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

50 x 1.00 = \ 50 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Murphy Dome LRR : Waste Accumulation Area No.2
Location: West of Power Plant
Date of Operation: 1950's to 1960's
Owner/Operator: U.S.Air Force
Comments/Description: Spills and leaks , primarily POL

Site Rated by: J.R.Absalon; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			116	180

Receptors subscore (100 x *factor* score subtotal/maximum score subtotal) 64

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	1	8	8	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			36	108
Subscore (100 x factor score subtotal/maximum score subtotal)				33
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			30	114
Subscore (100 x factor score subtotal/maximum score subtotal)				26

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 33

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		64		
Waste Characteristics		54		
Pathways		33		
Total	151	divided by 3 =	50	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

50 x 1.00 = 50

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Murphy Dome LRR : Waste Accumulation Area No.3
Location: Northwest of helicopter landing site
Date of Operation: 1950's to 1970's
Owner/Operator: U.S.Air Force
Comments/Description: Spills and leaks , primarily POL

Site Rated by: J.R.Absalon; R.L.Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			116	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 64

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	1	8	8	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			36	108
Subscore (100 x factor score subtotal/maximum score subtotal)				33
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. *Ground-water migration*				
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			30	114
Subscore (100 x factor score subtotal/maximum score subtotal)				26

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 33

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		64
Waste Characteristics		54
Pathways		33
Total	151	divided by 3 = 50 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

50 x 1.00 = 50

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Murphy Dome LRR : White Alice Site
Location: Southeast of housing and operations area
Date of Operation: 1950's to 1970's
Owner/Operator: U.S. Air Force
Comments/Description: Spills and leaks of oil with PCB

Site Rated by: J.R. Absalon; R.L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			122	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 68

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) S = suspected
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 1.00 = 40

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.00 = 40

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			44	108
Subscore (100 x factor score subtotal/maximum score subtotal)				41
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			30	114
Subscore (100 x factor score subtotal/maximum score subtotal)				26

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 41

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		68		
Waste Characteristics		40		
Pathways		41		
Total	149	divided by 3 =	50	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

50 x 1.00 = 50

FINAL SCORE

H.8 TIN CITY AFS

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Tin City LRR : Dump No. 1
Location: In valleys south of Upper Camp
Date of Operation: 1953 to 1978
Owner/Operator: U.S.Air Force
Comments/Description: Refuse, scrap metal, and POL wastes were disposed of off top of mountain
Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			148	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 82

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	2	8	16	24
Direct access to ground water	2	8	16	24
Subtotals			78	114
Subscore (100 x factor score subtotal/maximum score subtotal)				68

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 68

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	82
Waste Characteristics	54
Pathways	68

Total 204 divided by 3 = 68 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

68 x 1.00 = \ 68 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Tin City LRR : Landfill
Location: East of installation runway, Lower Camp.
Date of Operation: 1953 to present
Owner/Operator: U.S.Air Force
Comments/Description: Landfill has received waste oils, non-chlorinated solvents and other shop wastes
Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			131	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 73

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) M = medium
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.90 = 72

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

72 x 1.00 = 72

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			44	108
Subscore (100 x factor score subtotal/maximum score subtotal)				41
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			38	114
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 41

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		73	
Waste Characteristics		72	
Pathways		41	
Total	186	divided by 3 =	62 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

62 x 1.00 = \ 62 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Tin City LRR : Dump No. 2
Location: Between Lower Camp and Tin City Mine
Date of Operation: 1953 to 1978
Owner/Operator: U.S.Air Force
Comments/Description: Refuse, scrap metal, and POL wastes were disposed of in this area

Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			145	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 81

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		81
Waste Characteristics		54
Pathways		48
Total	183	divided by 3 = 61 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

61 x 1.00 = 61

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Tin City LRR : Waste Accumulation Area
Location: Between composite facility and power plant, Lower Camp.
Date of Operation: 1953 to present
Owner/Operator: U.S.Air Force
Comments/Description: Waste accumulation area and materials storage area for long period of time with potential for spills and leaks
Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			139	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 77

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Sub... = 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		77
Waste Characteristics		54
Pathways		48
Total	179	divided by 3 = 60 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

60 x 1.00 = 60

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Tin City AFS : Spill / Leak No. 2
Location: Lower Camp Incinerator
Date of Operation: 1979
Owner/Operator: U.S. Air Force
Comments/Description: 300 gallons of diesel fuel caused by pipeline break

Site Rated by: J.R. Absalon; R.M. Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			139	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 77

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			46	114
Subscore (100 x factor score subtotal/maximum score subtotal)				40

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		77		
Waste Characteristics		54		
Pathways		48		
Total	179	divided by 3 =	60	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

60 x 1.00 = 60

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Tin City AFS : Spill / Leak No. 1
Location: White Alice Site
Date of Operation: 1980
Owner/Operator: U.S. Air Force
Comments/Description: 850 gallons of diesel fuel caused by valve failure

Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			115	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 64

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			38	114
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		64		
Waste Characteristics		54		
Pathways		48		
Total	166	divided by 3 =	55	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

55 x 1.00 = 55

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Tin City LRR : White Alice Site
Location: North East of Lower Camp
Date of Operation: 1958 to 1975
Owner/Operator: U.S.Air Force
Comments/Description: Suspected PCB contamination from disposal of oil on ground

Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			115	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 64

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) S = suspected
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 1.00 = 40

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.00 = 40

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. *Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration.* Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. *Ground-water migration*				
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			38	114
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		64	
Waste Characteristics		40	
Pathways		48	
Total	152	divided by 3 =	51 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

51 x 1.00 = 51

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Tin City LRR : Runway Oiling
Location: Aircraft Runway, Lower Camp.
Date of Operation: 1953 to 1970's
Owner/Operator: U.S.Air Force
Comments/Description: Oiling of the runway is suspected as a disposal method

Site Rated by: J.R.Absalon; R.M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			131	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 73

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) S = suspected
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 0.90 = 36

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

36 x 1.00 = 36

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			44	108
Subscore (100 x factor score subtotal/maximum score subtotal)				41
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. *Ground-water migration*				
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			38	114
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 41

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		73	
Waste Characteristics		36	
Pathways		41	
Total	150	divided by 3 =	50 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

50 x 1.00 = 50

FINAL SCORE

APPENDIX I

GLOSSARY OF TERMINOLOGY

AND ABBREVIATIONS

APPENDIX I

GLOSSARY OF TERMINOLOGY

AND ABBREVIATIONS

ABG: Air Base Group.

ABS: Air Base Squadron.

ACFT MAINT: Aircraft Maintenance.

ACTIVE ZONE· That portion of the land surface, usually the uppermost one to six feet of soil which either freezes in winter or thaws in the spring. The active zone is a term used to differentiate the part of the land surface whose consistency changes with the season. The active zone directly overlies permafrost, which remains frozen, irrespective of the season.

AC&W: Aircraft Control and Warning.

ADC: Air Defense Command.

ADEC: Alaska Department of Environmental Conservation.

AEC: Atomic Energy Commission.

AF· Air Force.

AFB: Air Force Base.

AFCS: Air Force Communications Service.

AFESC: Air Force Engineering and Services Center.

AFFF: Aqueous Film Forming Foam, a fire extinquishing agent. AFFF concentrates include fluorinated surfactants plus foam stabilizers diluted with water to a 3 to 6% solution.

AFR: Air Force Regulation.

AFRCE: Air Force Regional Civil Engineer.

AFRES: Air Force Reserve.

AFS: Air Force Station (in this report often used interchangably with LRR).

AFSC: Air Force Systems Command.

Ag: Chemical symbol for silver.

AGE: Aerospace Ground Equipment.

AGS: Aircraft Generation Squadron.

Al: Chemical symbol for aluminum.

ALASCOM: Alaska Communications.

ALC: Air Logistics Center.

ALLUVIUM: Materials eroded, transported and deposited by streams.

ALLUVIAL FAN: A fan-shaped deposit formed by a stream either where it issues from a narrow mountain valley into a plain or broad valley, or where a tributary stream joins a main stream.

ALTIPLANATION TERRACE: A periglacial feature of Alaska, possessing at least one scarp and one tread surface. The tread may be 30 to several hundred feet in plan; the scarp may be three to 100 feet high. The terraces form parallel to ridgecrests as a result of frost and/or chemical bedrock weathering at a point beneath or around the fluctuating snowline. The weathered material is transported downslope by mass movement.

AMS: Avionics Maintenance Squadron

ANG: Air National Guard.

ANTICLINE: A fold in which layered strata are inclined down and away from the axes.

AROMATIC: Description of organic chemical compounds in which the carbon atoms are arranged into a ring with special electron stability associated. Aromatic compounds are often more reactive than non-aromatics.

APS: Aerial Port Squadron.

ARTESIAN: Ground water contained under hydrostatic pressure.

AQUICLUDE: Poorly permeable formation that impedes ground-water movement and does not yield to a well or spring.

AQUIFER: A geologic formation, group of formations, or part of a formation that is capable of yielding water to a well or spring.

AQUITARD: A geologic unit which impedes ground-water flow.

AREFG: Air Refueling Group.

ASC: Audiovisual Service Center.

ATC: Air Training Command.

AVGAS: Aviation Gasoline.

Ba: Chemical symbol for barium.

BEDROCK: Any solid rock exposed at the surface of the earth or overlain by unconsolidated material.

BEE: Bioenvironmental Engineer.

BES: Bioenvironmental Engineering Services.

BIOACCUMULATE: Tendency of elements or compounds to accumulate or build up in the tissues of living organisms when they are exposed to these elements in their environments, e.g., heavy metals.

BIODEGRADABLE: The characteristic of a substance to be broken down from complex to simple compounds by microorganisms.

BOWSER: A portable tank, usually under 200 gallons in capacity.

BX: Base Exchange.

$CaCO_3$: Chemical symbol for calcium carbonate.

CAMS: Consolidated Aircraft Maintenance Squadron.

CAP: Civilian Air Patrol.

Cd: Chemical symbol for cadmium.

CE: Civil Engineering.

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act.

CES: Civil Engineering Squadron.

CIRCA: About; used to indicate an approximate date.

CIRQUE: A deep, steep-walled, flat or gently-floored recess or hollow, semi-circular in plan, occurring high on mountain slopes or at the head of glacial valleys.

CLOSURE: The completion of a set of rigidly defined functions for a hazardous waste facility no longer in operation.

CMD: Command.

CMS: Component Maintenance Squadron.

CN: Chemical symbol for cyanide.

COASTAL PLAINS: Physiographic province characterized by a gently seaward sloping surface formed over exposed, unconsolidated, stratified marine or fluvial sediments. Typical coastal plain features include low hills and ridges, organic deposits, floodplains and high water tables.

COD: Chemical Oxygen Demand, a measure of the amount of oxygen required to oxidize organic and oxidizable inorganic compounds in water.

COE: Corps of Engineers.

COLLUVIUM: Sediments that have moved down slope primarily under the influence of gravity or as periodic, unchannelized flow. It frequently includes large boulders or other fragments which contrast this matrial to alluvium, material deposited by channelized flow which results in some degree of sorting according to particle size.

CONFINED AQUIFER: An aquifer bounded above and below by impermeable strata or by geologic units of distinctly lower permeability than that of the aquifer itself.

CONFINING UNIT: An aquitard or other poorly permeable layer which restricts the movement of ground water.

CONTAMINATION: The degradation of natural water quality to the extent that its usefulness is impaired; there is no implication of any specific limits since the degree of permissible contamination depends upon the intended end use or uses of the water.

CONUS: Continental United States.

CPM: Counts per minute (alpha radiation measurement).

Cr: Chemical symbol for chromium.

CRS: Component Repair Squadron.

CSG: Combat Support Group.

CSS: Combat Support Squadron.

Cu: Chemical symbol for copper.

CURIE: Unit for measuring radioactivity. One curie is the quantity of any radioactive isotope undergoing 3.7×10^{10} disintegrations per second.

D: Disposal Site.

DEQPPM: Defense Environmental Quality Program Policy Memorandum

DELTA (DELTAIC): Low, nearly flat segment of land that appears to be roughly triangular or fan-shaped, deposited by river flow at a junction with a larger water body such as a lake or sea. The delta may enclose

and be crossed by distributaries of the main river. Deltaic deposits usually possess distinctive sedimentary features recognized by geologists.

DET: Detachment.

DIP: The angle measured from the horizontal that a structural feature makes. Structural features may include bedding, folds, faults, etc. Dip is measured in degrees of the vertical plane, normal to strike.

DISPOSAL FACILITY: A facility or part of a facility at which hazardous waste is intentionally placed into or on land or water, and at which waste will remain after closure.

DISPOSAL OF HAZARDOUS WASTE: The discharge, deposit, injection, dumping, spilling, or placing of any hazardous waste into or on land or water so that such waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground water.

DOD: Department of Defense.

DOWNGRADIENT: In the direction of decreasing hydraulic static head; the direction in which ground water flows.

DPDO: Defense Property Disposal Office, previously included Redistribution and Marketing (R&M) and Salvage.

DRUMLIN: A low, rounded elongated hill, ridge or mound formed as a result of the glacial deposition of dense till, oriented in the direction of the glacier's movement.

DUMP: An uncovered land disposal site where solid and/or liquid wastes are deposited with little or no regard for pollution control or aesthetics; dumps are susceptible to open burning and are exposed to the elements, disease vectors and scavengers.

EFFLUENT: A liquid waste discharge from a manufacturing or treatment process, in its natural state, or partially or completely treated, that discharges into the environment.

ELECTRICAL RESISTIVITY (ER): Specialized equipment designed to produce an electrical current through subsurface geologic strata. The instrument and the technique permit the operator to examine conditions at specific depths below land surface. Subsurface contrasts indicative of specific geologic or hydrologic conditions may be obtained through correlation of the ER data with known site information such as that provided by test borings or well construction logs.

EMS: Equipment Maintenance Squadron.

ENT: Ear, Nose and Throat, an area of medical specialization.

EOD: Explosive Ordnance Disposal.

EP: Extraction Procedure, the EPA's standard laboratory procedure for leachate generation.

EPA: U.S. Environmental Protection Agency.

EPHEMERAL: Short-lived or temporary.

EPHEMERAL AQUIFER: A water-bearing zone typically located near the surface which normally contains water seasonally.

EQUIPOTENTIAL: Lines or contours having equal value. An equipotential map is one which uses contour lines to represent zones of equal water levels. The contours also indicate the directions of increasing and decreasing water levels.

EROSION: The wearing away of land surface by wind, water, or chemical processes.

ES: Engineering-Science, Inc.

ESCARPMENT: A long, usually continuous cliff or relatively steep slope facing one general direction, breaking the continuity of the land by separating two level or gently sloping surfaces; produced by erosion or faulting.

ESKER: A long, low, narrow steep-walled ridge composed or irregularly bedded sand and gravel deposited by a glacial stream flowing between the ice walls or in an ace tunnel of a retreating glacier.

FAA: Federal Aviation Administration.

FACILITY (As Applied to Hazardous Wastes): Any land and appurtenances thereon and thereto used for the treatment, storage and/or disposal of hazardous wastes.

FACP: Forward Air Control Post.

FAULT: A fracture in rock along which the adjacent rock surfaces are differentially displaced.

Fe: Chemical symbol for iron.

FIRN (LINE): A material which is transitional between snow and glacier ice, being older and denser than snow but not as dense as ice. Snow becomes firn after passing through one summer melt season. Firn becomes glacier ice when its permeability to water is considered to be zero. The firn line is the highest level to which the winter snow cover retreats on a glacier (aka: snowline). Also, the edge of the snow cover at the end of the summer season.

FLOOD PLAIN: The lowland and relatively flat areas adjoining inland and coastal areas of the mainland and off-shore islands, including, at a minimum, areas subject to a one percent or greater chance of flooding in any given year.

FLOW PATH: The direction or movement of ground water as governed principally by the hydraulic gradient.

FMS: Field Maintenance Squadron.

FOB: Forward Operating Base.

FPTA: Fire Protection Training Area.

GATR: Ground to Air Transmitter Receiver Site.

GC/MS: Gas chromatograph/mass spectrophotometer, a laboratory procedure for identifying unknown compounds.

GEOPHYSICS: (Geophysical survey) the use of one or more geophysical instruments or methods to measure specific properties of the earth's subsurface through indirect means. Geophysical equipment may include electrical resistivity, geiger counter, magnetometer, metal detector, electromagnetic conductivity, magnetic susceptibility, etc. Geophysics seeks to provide specific measurements of the earth's magnetic field, the electrical properties of specific geologic strata, radioactivity, etc.

GLACIAL TILL: Unsorted and unstratified drift consisting of clay, sand, gravel and boulders which is deposited by or underneath a glacier.

GLACIOFLUVIAL: Refers to materials deposited in streams produced by melting glaciers. Pertains to deposits or landforms composed of characteristically bedded coarse particulate matter.

GLACIOLACUSTRINE: Refers to materials deposited in glacial lakes. Pertains to deposits or landforms composed chiefly or suspended particles transported by meltwater streams flowing into the lakes bordering a retreating glacier. The sediments may exhibit certain unusual characteristics, such as seasonal varves (alternating silt and clay layers delineating each seasonal change).

GLAUCONITIC SAND AND GRAVEL: A mixture of sand, gravel and glauconite, an iron-potassium silicate mineral which imparts a green color to the mixture. Glauconite is geologically significant because it indicates slow sedimentation.

GLIDE-BLOCK: A large section of a geologic unit that has separated from the main portion of the unit due to earthquake/landslide-induced lateral movement.

GROUND WATER: Water beneath the land surface in the saturated zone that is under atmospheric or artesian pressure.

GROUND WATER RESERVOIR: The earth materials and the intervening open spaces that contain ground water.

HALF-LIFE: The time required for half the atoms present in radioactive substance to disintegrate.

HALOGEN: The class of chemical elements including fluorine, chlorine, bromine, and iodine.

HARDFILL: Disposal sites receiving construction debris, wood, miscellaneous spoil material.

HARM: Hazard Assessment Rating Methodology.

*HAZARDOUS SUBSTANCE: Under CERCLA, the definition of hazardous substance includes:

1. All substances regulated under Paragraphs 311 and 307 of the Clean Water Act (except oil);

2. All substances regulated under Paragraph 3001 of the Solid Waste Disposal Act;

3. All substances regulated under Paragraph 112 of the Clean Air Act;

4. All substances which the Administrator of EPA has acted against under Paragraph 7 of the Toxic Substance Control Act;

5. Additional substances designated under Paragraph 102 of CERCLA.

*HAZARDOUS WASTE: As defined in RCRA, a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

HAZARDOUS WASTE GENERATION: The act or process of producing a hazardous waste.

HEAVY METALS: Metallic elements, including the transition series, which include many elements required for plant and animal nutrition in trace concentrations but which become toxic at higher concentrations.

Hg: Chemical symbol for mercury.

HQ: Headquarters.

HWAP: Hazardous Waste Accumulation Point.

HWMF: Hazardous Waste Management Facility.

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*See pags 4-1 and 4-2 for hazardous wastes defined for this study.

HYDROCARBONS: Organic chemical compounds composed of hydrogen and carbon atoms chemically bonded. Hydrocarbons may be straight chain, cyclic, branched chain, aromatic, or polycyclic, depending upon arrangement of carbon atoms. Halogenated hydrocarbons are hydrocarbons in which one or more hydrogen atoms has been replaced by a halogen atom.

ICING (AUFEIS FIELD): Three to 20-feet thick masses of surface ice caused by the release of water under hydrostatic pressure. It may occur in frozen rivers as a result of ice-trapped water suddenly released, forming an ice field over a broad area of the flood plain, or may occur at any topographically low area where the continual discharge of confined ground water forms a broad ice sheet as successive water flows spread and freeze over the land surface.

INCOMPATIBLE WASTE: A waste unsuitable for commingling with another waste or material because the commingling might result in generation of extreme heat or pressure, explosion or violent reaction, fire, formation of substances which are shock sensitive, friction sensitive, or otherwise have the potential for reacting violently, formation of toxic dusts, mists, fumes, and gases, volatilization of ignitable or toxic chemicals due to heat generation in such a manner that the likelihood of contamination of ground water or escape of the substance into the environment is increased, any other reaction which might result in not meeting the air, human health, and environmental standards.

INFILTRATION: The movement of water through the soil surface into the ground.

IRP: Installation Restoration Program.

ISOPACH: Graphic presentation of geologic data, including lines of equal unit thickness that may be based on confirmed (drill hole) data or indirect geophysical measurement.

ISOTOPE: Two or more species of atoms of the same chemical element, with the same atomic number and place in the periodic table, and nearly identical chemical properties, but with different atomic mass numbers and different physical properties; an example may be the radioactive isotope - Carbon (12) and Carbon-14.

JP-4: Jet Propulsion Fuel Number Four; contains both kerosene and gasoline fractions.

JP-5: Jet Propulsion Fuel Number Five; consists of high boiling kerosene fractions.

JSS: Joint Surveillance System.

KAME: A long, low steep-walled hill, mound or short irregular ridge composed primarily of poorly sorted and stratified silt, sand and gravel deposited by a subglacial stream as an alluvial fan or delta against or on the margin of a melting glacier. Generally, kames are aligned parallel to the ice front.

KETTLE: A depression remaining in glacial drift after an isolated ice mass melts. Some kettles fill with ground water, becoming kettle lakes.

LANDFILL: Land disposal site used for disposing solid and semi-solid materials. May refer either to a sanitary landfill or dump.

LEACHATE: A solution resulting from the separation or dissolving of soluble or particulate constituents from solid waste or other man-placed medium by percolation of water.

LEACHING: The process by which soluble materials in the soil, such as nutrients, pesticide chemicals or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

LENTICULAR: A bed or rock stratum or body that is lens-shaped.

LINER: A continous layer of natural or man-made materials beneath or on the sides of a surface impoundment, landfill, or landfill cell which restricts the downward or lateral escape of hazardous waste, hazardous waste constituents or leachate.

LITHOLOGY: The description of the physical character of a rock.

LOESS: An essentially unconsolidated unstratified calcareous silt; commonly homogeneous, permeable and buff to gray in color.

LOX: Liquid Oxygen.

LRR: Long-Range Radar (in this report often used interchangeably with AFS).

LYSIMETER: A vacuum operated sampling device used for extracting pore water samples at various depths within the unsaturated zone.

m: Milli (10^{-3}).

MAC: Military Airlift Command.

MAGNETOMETER (MG): A device capable of measuring localized variations in the earth's magnetic field that may be due to disturbed areas such as backfilled trenches, buried objects, etc. Measurements may be obtained at points located on a grid pattern so that the data can be contoured, revealing the location, size and intensity of the suspected anomaly.

MAINT: Recording System Maintenance.

MAJCOM: Major Command. Intermediate level of management within the Air Force.

MAR: Minimally Attended Radar

MATS: Military Air Transport Service.

MAW: Military Airlift Wing.

MEK: Methyl Ethyl Ketone.

MESOZOIC: Of, or designating the geologic era occurring between the Paleozoic (older) and the Cenozoic (younger). The Mesozoic era began about 240 million years before present (B.P.) and ended about 63 million years B.P.

METALS: See "Heavy Metals".

mgd: Million Gallons per Day.

MIBK: Methyl Isobutyl Ketone.

MICRO: u (10^{-6})

ug/1: Micrograms per liter.

mg/l: Milligrams per liter.

MOA: Military Operating Area.

MOGAS: Motor gasoline.

Mn: Chemical symbol for manganese.

MODIFIED MERCALLI INTENSITY: A number describing the effects of an earthquake on man, structures and the earth's surface. A Modified Mercalli Intensity of I is not felt. An intensity of VI is felt indoors and outdoors and for an intensity of VII it becomes difficult for a man to remain standing. Intensities of IX to XII involve increasing levels of destruction with destruction being nearly total at an intensity of XII.

MONITORING WELL: A well used to measure ground-water levels and to obtain ground-water samples for water quality analyses. As distinguished from observation wells, monitoring wells are often designed for longer term operations. They are constructed of materials for the site-specific climatic, hydrogeologic and contaminant conditions.

MORAINE: A mount, ridge or other topographic projection above ground composed of dense unsorted, unstratified till, deposited by glacial ice. A terminal moraine is an arc-shaped ridge which is considered to be a delineation of the glacier's greatest advance.

mr/hr: Millirem per hour; a measure of radioactivity.

MSL: Mean Sea Level.

MUNITION ITEMS: Munitions or portions of munitions having an explosive potential.

MUNITIONS RESIDUE: Non-explosive segments of waste munitions (i.e., bomb casings).

MUSKEG: A bog or densely vegetated swamp common to arctic or subarctic climates, consisting of tussocks of deep accumulations of organic matter, growing in wet, poorly drained areas. Underlying permafrost is usually the reason muskeg develops, as it restricts vertical drainage.

MWR: Morale Welfare and Recreation.

NCO: Non-commissioned Officer.

NCOIC: Non-commissioned Officer In-Charge.

NDI: Non-destructive Inspection.

NET PRECIPITATION: The amount of annual precipitation minus annual evaporation.

NGVD: National Geodetic Vertical Datum of 1929. A national datum system, tied to Mean Sea Level, but referenced primarily to land-based benchmarks.

Ni: Chemical symbol for nickel.

NOAA: National Oceanic and Atmospheric Administration.

NON-CALCAREOUS: Not bearing calcium carbonate ($CaCO_3$) a characteristic mineral of marine paleoenvironment.

NORAD: North American Air Defense Command

NPDES: National Pollutant Discharge Elimination System.

NSS: Norad Surveillance Station

OBSERVATION WELL: An informally designed cased well, open to a specific geologic unit or formation, designed to allow the measurement of physical ground-water properties within the zone or unit of interest. Observation wells are designed to permit the measurement of water levels and in-situ parameters such as ground-water (flow velocity and flow direction. Not to be confused with a monitoring well, a well designed to permit accurate ground-water quality monitoring. Monitoring wells are constructed of materials compatible with site-specific climatic, hydrogeologic and contaminant conditions. Monitoring well installation and construction is planned to have minimal impacts on apparent ground-water quality and will often be for longer term operation compared with observation wells.

OEHL: USAF Occupational and Environmental Health Laboratory.

OIC: Officer-In-Charge.

OMS: Organizational Maintenance Squadron.

OPNS: Operations.

ORGANIC: Being, containing or relating to carbon compounds, especially in which hydrogen is attached to carbon.

OSI: Office of Special Investigations.

O&G: Symbols for oil and grease.

OUT CROP: Zone or area of exposure where a geologic unit or formation occurs at or near land surface. "Outcrop area" is an important factor in hydrogeologic studies as this zone usually corresponds to the point where significant recharge occurs. When this term is used as an intransitive verb: "Where the unit crops out....."

OXIDIZER: Material necessary to support combustion of fuel.

Pb: Chemical symbol for lead.

PCB: Polychlorinated Biphenyl; liquids used as a dielectrics in electrical equipment.

PD-680: Cleaning solvent; petroleum distillate, Stoddard solvent.

PERCHED WATER TABLE: A water table above a relatively impermeable zone underlain by unsaturated rocks of sufficient permeability to allow ground-water movement.

PERCOLATION: Movement of moisture by gravity or hydrostatic pressure through interstices of unsaturated rock or soil.

PERMAFROST: Any soil, subsoil, surficial deposit or bedrock occurring in arctic or subarctic regions at a variable depth below the Earth's surface in which a termperature below freezing has existed continuously for a long time (two to thousands of years). The definition is based on temperature and does not consider the material, water content, etc. Permafrost, in its common usage is taken to mean frozen soil or rock, which is generally impermeable to water.

PERMEABILITY: The relative rate of water flow through a porous medium. The USDA, Soil Conservation Service describes permeability qualitatively as follows:

very slow	<0.06	inches/hour
slow	0.06 to 0.2	inches/hour
moderately slow	0.2 to 0.6	inches/hour
moderate	0.6 to 2.0	inches/hour
moderately rapid	2.0 to 6.0	inches/hour
rapid	6.0 to 20	inches/hour
very rapid	>20	inches/hour

PERSISTENCE: As applied to chemicals, those which are very stable and remain in the environment in their original form for an extended period of time.

PESTICIDE: An agent used to destroy pests. Pesticides include such specialty groups as herbicides, fungicides, insecticides, etc.

pH: Negative logarithm of hydrogen ion concentration.

Pico: 10^{-12}

PINGO: (Eskimo term, "conical hill") a relatively large conical mound or hill composed of soil covered ice, raised by hydrostatic pressure of ground water within or below the permafrost of arctic and subarctic areas. The crest may be collapsed or open due to melting of the enclosed ice. The mount may resemble a small volcano.

PL: Public Law.

PMEL: Precision Measurement Equipment Lab.

POL: Petroleum, Oils and Lubricants.

POLLUTANT: Any introduced gas, liquid or solid that makes a resource unfit for a specific purpose.

POLYCYCLIC COMPOUND: All compounds in which carbon atoms are arranged into two or more rings, usually aromatic in nature.

POTENTIALLY ACTIVE FAULT: A fault along which movement has occurred within the last 25-million years.

POTENTIOMETRIC SURFACE: The imaginary surface to which water in an artesian aquifer would rise in tightly screened wells penetrating it.

ppb: Parts per billion by weight.

ppm: Parts per million by weight.

PRECIPITATION: Rainfall.

PROPELLANT: fuels, oxiders and monopropellants.

QUATERNARY MATERIALS: The second period of the Cenozoic geologic era, following the Tertiary, and including the last 2-3 million years.

QAE: Quality Assurance Evaluator.

QUICKTRANS: Automated Terminal Service.

RCRA: Resource Conservation and Recovery Act.

RD: Low-level radioactive waste disposal site.

RECEPTORS: The potential impact group or resource for a waste contamination source.

RECHARGE AREA: A surface area in which surface water or precipitation percolates through the unsaturated zone and eventually reaches the zone of saturation. Recharge areas may be natural or manmade.

RECHARGE: The addition of water to the ground-water system by natural or artificial processes.

RECON: Reconnaissance.

RESISTIVITY: See Electrical Resistivity

RIPARIAN: Living or located on a riverbank.

RM: Resource Management.

ROCC: Region Operations Control Center

RWDS: Radioactive Waste Disposal Site.

S: Storage site method.

SAC: Strategic Air Command.

SANITARY LANDFILL: A land disposal site using an engineered method of disposing solid wastes on land in a way that minimizes environmental hazards.

SAPROLITE: A residual soil retaining the physical appearance or former structure of the parent rock.

SATURATED ZONE: That part of the earth's crust in which all voids are filled with water.

SAX'S TOXICITY: A rating method for evaluating the toxicity of chemical materials.

SCS: U.S. Department of Agriculture Soil Conservation Service.

SEISMICITY: Pertaining to earthquakes or earth vibrations.

SLUDGE: The solid residue resulting from a manufacturing or wastewater treatment process which also produces a liquid stream. The residue which accumulates in liquid fuel storage tanks.

SOLE SOURCE: As in aquifer. The only source of potable water supplies of acceptable quality available in adequate quantities for a significant population. Sole source is a legal term which permits use control of the aquifer by designated regulatory authorities.

SMART: Structural maintenance and repair team.

SOLID WASTE: Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations and from community activities, but does not include solid or dissolved materials in domestic sewage; solid or dissolved materials in irrigation return flows; industrial discharges which are point source subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended (86 USC 880); or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (68 USC 923).

SP: Spill area.

SPILL: Any unplanned release or discharge of a hazardous waste onto or into the air, land, or water.

SPIT: A narrow segment of land projecting into a body of water.

SS: Supply Squadron.

STORAGE OF HAZARDOUS WASTE: Containment, either on a temporary basis or for a longer period, in such a manner as not to constitute disposal of such hazardous waste.

STP: Sewage Treatment Plant.

STRIKE: The compass direction or trend taken by a structural feature, such as bedding, folds, faults, etc. Strike is measured at a point when the specific feature intersects the topographic surface.

SUBPERMAFROST: Refers to materials or ground water located beneath the lower limits of permanently frozen ground of a particular area.

SUPRAPERMAFROST: Refers to materials or ground water located above the upper limits of frozen ground of a particular area. Suprapermafrost ground water freezes in winter and melts and flows during the spring-summer melt and thaw cycle. Suprapermafrost refers to the active zone, that portion of land above permafrost which is subject to seasonal climatic variations.

SUPS: Supply Squadron.

T: Treatment site method.

TAC: Tactical Air Command.

TACC: Tactical Air Control Center.

TACS: Tactical Air Control System.

TALIK: A russian term for an unfrozen zone within, above or beneath permafrost, usually occurring in the discontinuous permafrost areas south of the Arctic Circle. A perforating talik is an unfrozen area extending through a relatively continuous permafrost zone, permitting local groundwater circulation.

TALUS: Weathered rock materials accumulating at the base of a cliff or mountain by mass movement.

TASS: Tactical Air Support Squadron.

TCA: 1,1,1,-Tetrachloroethane.

TCE: Trichloroethylene, a solvent and suspected carcinogen.

TCG: Tactical Control Group

TDS: Total Dissolved Solids.

TECTONIC (ally): Said of or pertaining to the forces and resulting structural or deformational features evident in the earth's crust. Tectonics usually deals with the broad architecture of the earth's outer crust.

TFTS: Tactical Fighter Training Squadron.

TFW: Tactical Fighter Wing.

THAW LAKE: A lake or pool of water formed on the surface of a glacier by accumulation of melt water. Sometimes taken to mean the local accumulation of water, ponding in temporary impoundments due to rapid melting of the active zone during the spring-summer melt and thaw cycle.

TIDAL STRIP: Physiographic subdivision commonly associated with (ocean) wave activity. Usually includes berms, beach ridges, tidal flats and related landforms typically produced by coastal erosional and depositional processes.

TMDE: Test Measurement and Diagnostic Equipment.

TOC: Total Organic Carbon.

TOXICITY: The ability of a material to produce injury or disease upon exposure, ingestion, inhalation, or assimilation by a living organism.

TRANS: Transportation Squadron.

TRANSMISSIVITY: The rate at which water is transmitted through a unit width of aquifer under a unit hydraulic gradient.

TREATMENT OF HAZARDOUS WASTE: Any method, technique, or process including neutralization designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize the waste or so as to render the waste nonhazardous.

TS: Transportation Squadron.

TSD: Treatment, storage or disposal sites/methods.

TTS: Technical Training Squadron.

TTW: Technical Training Wing.

TUNDRA: A treeless, level to gently undulating plain, possessing a marshy or wetland surface common to arctic and subarctic regions. Tundra wetness is generally due to the presence of underlying permafrost, which restricts vertical drainage.

UPGRADIENT: In the direction of increasing hydraulic static head; the direction opposite to the prevailing flow of ground-water.

US: United States.

USAF: United States Air Force.

USAFSS: United States Air Force Security Service.

USDA: United States Department of Agriculture.

USFWS: United States Fish and Wildlife Service.

USGS: United States Geological Survey.

USMC: United States Marine Corps.

USN: United States Navy.

WACS: White Alice Communication System

WATER TABLE: Surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

WWTP: Wastewater Treatment Plant.

Zn: Chemical symbol for zinc.

APPENDIX J

REFERENCES

APPENDIX J

REFERENCES

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